An ART SUPPLEMENT is given Gratis with this Number.

WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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VOL. III.—No. 105.] SATURDAY, MARCH 21, 1891. [PRICE ONE PENNY.

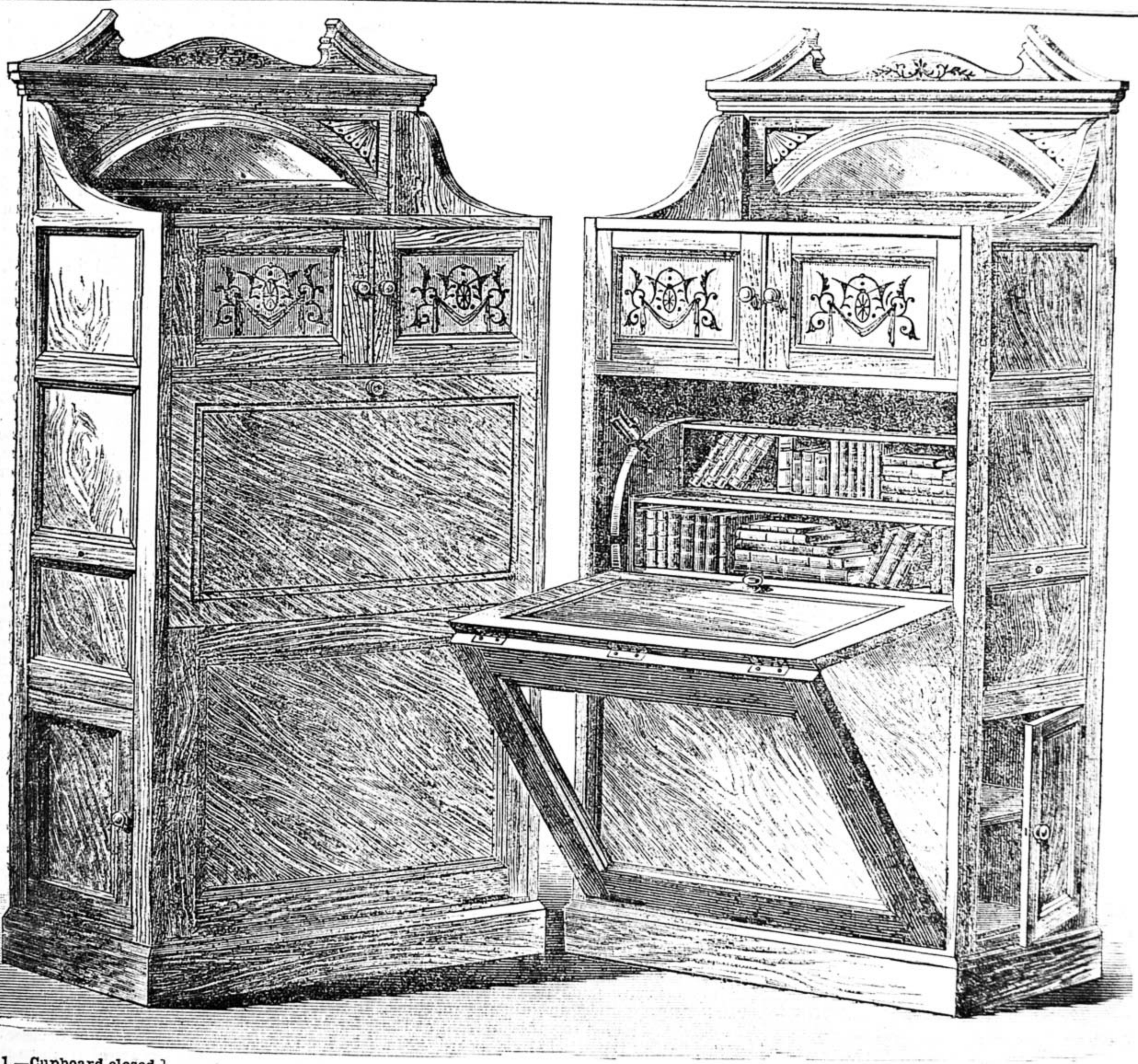


Fig. 1.—Cupboard closed.] [Fig. 2.—Cupboard open.

A WRITING CUPBOARD, WITH ADJUSTABLE WRITING FLAP AND BOOKSHELVES REVOLVING HORIZONTALLY.

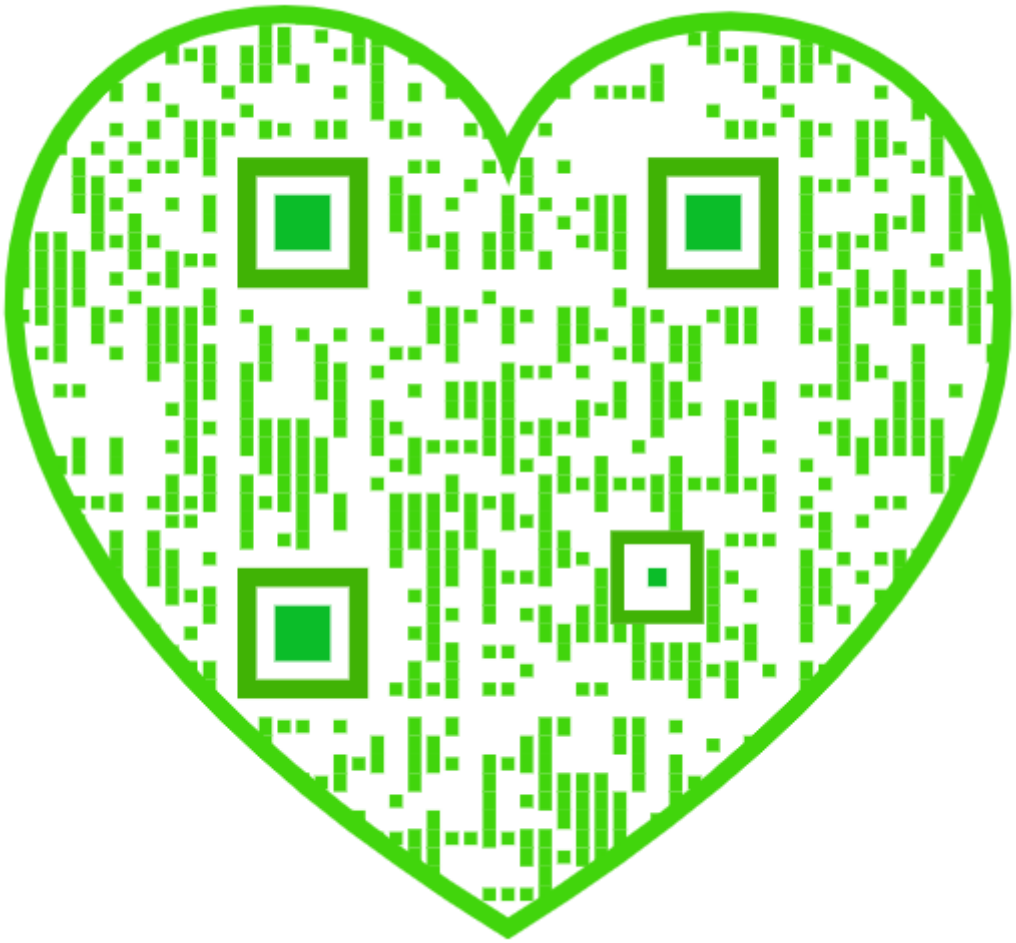
A WRITING CUPBOARD, WITH ADJUSTABLE FLAP AND BOOKCASE REVOLVING HORIZONTALLY.

BY JAMES SCOTT.

UTILITY OF CUPBOARD—CONSTRUCTION—BOOKCASE AND BOOK BOXES—SMALL CUPBOARD AT TOP—PLINTH—DIMENSIONS AND MODE OF MAKING—BACKBOARD—DOORS—PEDIMENT—REVOLVING BOOKSHELVES—WRITING FLAP—FINISHING.

MANY a man may find such an article as I have designed for this week a welcome addition to his home. I say "home," because I have specially intended it to be of more service there than in business departments, although in the latter it would certainly be found very useful. In most offices, however, the adjustable writing flap would not have much advantage over the ordinary writing-desk tables, as very few men indeed would like to clear the papers from it every night in order to shut up the cupboard.

But, as before said, in the home it may find a welcome. There are several persons who find it a matter of necessity, or perhaps pleasure, when they are within their homes, to write or study occasionally; and this combined bookcase and writing table, possessing, as it does, a few advantages over



ordinary articles of the kind, will enable them to do so as comfortably and conveniently as possible.

As may be seen by a glance at Figs. 1 and 2, very little trouble will be occasioned to put the article into position for use as a writing table or bookcase. The cupboard has, in front, a flap and a rather wide framing hinged together. In opening the cupboard, the catch at the top of the flap is released, and an arrangement (of which more will be said later on) prevents the top edge of it coming from between the cupboard sides, with the natural result that (the bottom of the lower framing being hinged as in Figs. 1 and 2) the flap is adjusted on the slope, and is adequately supported by the lower framing, etc.

The framing is much to be preferred to a solid board, as there will then be sufficient accommodation for the knees of the person who may be writing at the article.

The other feature of the cupboard, and one that will, I think, be considered a novel and useful one, is that of the bookcase being so made and fixed as *to revolve horizontally*. The advantage of this feature will, perhaps, be readily conceived. A series of boxes, of which one is shown in Fig. 16, all of one size, or of different dimensions (provided, in the latter case, space is properly allotted for their movements), are pivoted between two circular boards, which, in their turn, are pivoted to the sides of the cupboard. A person may be occupied writing at the desk, and find it necessary now and again to make reference to some particular volume or paper in his possession. With the ordinary secretary bookcase, supposing the volume required was on the top shelf, this would necessitate his rising from his seat; and in the present case, with so large a writing flap, this would be found doubly inconvenient; but as the shelves revolve horizontally, the volume can be obtained by turning the boxes until that one in which it is contained comes round to the front.

If all the book boxes are the same size, and are generally proportionately stocked, whenever the hands were taken from the case after revolving it, it would remain steady; but as differently sized boxes may be used, or, if all one sized are made use of, some shelves might be well filled, while others were half empty, I have shown how the case can be kept steady by means of a bolt fitted within the cupboard, which will enter into notches or holes in the edges of the two circular boards at the ends of the case. It will be best to countersink the heads of *all* pivots, so that none of them may interfere with the free revolutions of the boxes.

In Figs. 3, 4, and 5, I have given elevations of three bookcases; in one diagram showing equally sized boxes, and in the other two, boxes of different dimensions. Other sizes may be made, but they will have to be worked out very carefully, for in revolving, unless proper space is allowed for the movements of each box, some will knock one against another. My diagrams are drawn to $1\frac{1}{4}$ in. scale, and those who understand scales will have no difficulty in finding what size each is intended to be. Here are a few hints, however, for those who do not understand scales, and who, by their ignorance are unable to arrive at any conclusions concerning what, at some time or another, may have been, or shall be, said. If $\frac{3}{4}$ in. scale is alluded to, all that need be done is to have a narrow piece of card or paper, and from an ordinary rule or measure indicate upon it a sufficient number of spaces, each $\frac{1}{4}$ in. long, and divide the first space into twelve equal parts. For any other scale, this same method should be followed, of course making each scale the length of the figure given, and always dividing the first space into twelve equal parts, which will represent inches. When a drawing or diagram is said to be drawn to a certain scale, the rule with that scale marked upon it should be used to measure the diagram or drawing, every large space representing a foot, and every small space an inch. These remarks may seem to some unnecessary, but I have personally met with men who have thanked me for the simple information. I shall give the dimensions of the equally sized boxes in due course, but shall leave the others to the reader.

I have represented in my design a small cupboard at the top, which may be found convenient for a good many purposes, but, of course, I need not say that it is not indispensable.

The suggestion of the bookshelves revolving, as shown in the design, may be turned to use separately and apart from the writing table, such as adapting it upon a table within a case, with either one or two doors on one side or on each side.

Sketches of one way of making the plinth are shown in Figs. 10 and 11. The latter represents a top view of it, and the former an under view, showing corner blocks inserted to add to its strength, and also to which castors (if they are required) may be screwed.

Fig. 16.—One of the Hanging Book Boxes.

The length of it will be $46\frac{1}{2}$ in., the width 20 in., the depth 5 in., and thickness of boards, say, $\frac{3}{4}$ in. To this is screwed the top carcass.

I have intended the sides of the cupboard to be "mock"-panelled—*i.e.*, a whole board with beading mitred and glued on to it; but, of course, with this article, properly panelled sides may be used, as the only boards joining them crossways will be the top and bottom boards and the board forming the bottom of the top cupboard. The shelf at the bottom of the job need only fit loosely on to a ridge screwed inside the cupboard to support it.

The length of the cupboard sides in front will be $62\frac{1}{2}$ in., and at the back 75 in.; the width 18 in.; and the thickness, I think (as the job is really so open), no less than $1\frac{1}{2}$ in. The small doors at the bottom might each be 22 in. long and 15 in. wide.

The top and bottom boards of the article, and the bottom board of the small top cupboard, will each be 42 in. long and 18 in. wide (all my measurements in this paper allow sufficient for joining), and about $\frac{7}{8}$ in. thick. The sides are joined together in front at the bottom half of the article by a board 42 in. long, 26 in. wide, and $\frac{3}{4}$ in. thick. This board will be necessary to form a background for the knee-framing, unless, in place of the latter, a whole board is used, which I certainly do not advise, on account of the inconvenience it will create. The board should be joined at a distance from the edges of the side boards equal to the thickness of the front framing.

I always prefer the back board of an article of this kind to be made as one whole thick board instead of thin matchboard. The height of it should be $62\frac{1}{2}$ in., the top edge of it thus coming flush with the top surface of the top boards.

The doors of the top cupboard will each be $19\frac{3}{4}$ in. long, $10\frac{1}{2}$ in. wide, and $\frac{5}{8}$ in. thick. Panels of, say, $\frac{3}{8}$ in. stuff, nicely inlaid, carved, incised, or stencilled, will rob the article of some of its plainness. I have not intended this small cupboard to have a division down its middle; a piece of moulding will be glued on to one of the door edges, as shown by A in Fig. 18.

The pediment and the top back board containing the looking-glass are shown in Figs. 8 and 9. The top edge of the larger back board must be cut to receive the bottom of this part, which should be screwed to the larger back board and to the back edge of each side board. The height from the bottom edge to the top of the straight moulding will be about 15 in.

The revolving bookshelves or boxes now claim attention. Two circular boards, each 18 in. in diameter, and about $1\frac{1}{4}$ in., or even $1\frac{1}{2}$ in., thick, are pivoted with good, strong pegs to the inside of the job. On the outside these pivots need not show, my sole purpose for showing them in my drawings being merely to indicate their position.

Taking the boxes represented in Fig. 3, the length of them will be $36\frac{1}{2}$ in. or 37 in., according to the thickness of the circular boards, the depth 7 in., the width 6 in., and the thickness of the boards composing them $\frac{1}{2}$ in.; the pivots connecting them with the circular boards being driven through precisely the spots I show, each one being at 2 in. from the edge of the circular boards. When fitted in its proper place, the bookcase will, if equally weighted, as I said before, remain in the position it may be left after turning it round; but a bolt, or something similar, is to be preferred, and whatever is used must work only in the *edge* of the circular boards, and *not on the surface*, as in the latter case it would interfere with the free movements of the boxes, and they would thus become utterly useless. A bolt need only be fitted on one side, unless very heavy books are within the case. It will be fitted as in Fig 12, and the edge of the circular board may be either as in that diagram, *i.e.*, with holes drilled into it, or, as in Fig. 13, with notches. To further support the case, I should advise the screwing to the sides of the article, directly underneath the circular boards, of stout pieces of board, as in Fig. 6.

I should not recommend the fixing of a board underneath the bookcase, other than that shown in Fig. 2, as if one is used, should a book or paper accidentally fall from the boxes, great difficulty would be experienced in getting it up again; whereas, should one fall, if the article is made as I intend it to be, it would lodge upon the lower shelf, and thus be very easy to get at.

I do not say that the present article, so far as the bookshelves are concerned, would be found desirable where it is not necessary to write at the same time as referring to the books; although, after all, little extra trouble would be required to obtain a book by drawing down the flap than would be caused by opening an ordinary bookcase, the extra trouble being that, unless the book wanted was in view, the shelves would have to be turned; but, as before said, this is a decided advantage when sitting at the desk.

Attention must now be given to the writing flap. A very convenient size for it will be 39 in. by 18 in. It will be hinged

to the under framing as shown; which latter might be 26 in. wide, with a moulding round its inner edge. The flap I have represented as having a couple of lines incised round it. Of course, a moulding would be entirely out of the question.

If the flap were lined with ornamented leather, or leather cloth, it would not be found an objectionable feature of the article when closed, and would certainly be better for writing purposes than the bare wooden surface. The thickness of the flap and framing should be about ¾ in.; and here let me add that both will work better if the edges which meet are canted and hinged as in Fig. 15. A neat, strong catch will be required to keep the flap up as in Fig. 1.

A groove must be cut from just underneath the top cupboard to the top edge of the front board, in each side board, as in Fig. 7. Behind the writing flap, at each side near the top edge, will be a peg, as shown in Fig. 17. The protruding end of this peg will be inserted in the groove A A, and it is this that will keep that part of the flap always between the cupboard sides.

I have not provided any place for stationery; but, if considered inconvenient to keep it in one of the revolving boxes, a compartment could be fitted in front between the cupboard sides and under the top cupboard, where it would not interfere with the freedom of the book-boxes.

A HANGING MUSIC CANTERBURY IN FRETWORK.

BY J. W. GLEESON-WHITE.

[*For Illustration of Canterbury complete, and Full-size Working Drawings of Parts in Fretwork, see Supplementary Sheet presented with this Number.*]

WHY a whatnot with receptacles for music is called a Canterbury it boots not to inquire. Enough that it be so, and that, whilst explaining the meaning of the article to be constructed after the annexed design, it was easier to use the accepted word. Anything less suited for its actual purpose ought to be difficult to parallel, yet, even as Herbert Spencer points out in his first chapter of a "Study of Sociology," it is an unfortunate truth that we all make shift with ineffective but conventional articles, when a little common-sense, or ingenuity of a very mild degree, would fit them for their purpose to a far greater extent.

The orthodox Canterbury does hold a series of bound volumes of folio music in a fairly satisfactory way—that is, if music books must needs repose upon their edges, in a different fashion to ordinary volumes. But our music in daily use (or, at all events, the newest pieces) is seldom, if ever, bound into stiff volumes; and to contain a quantity of sheet music, there is no word to offer in its defence. It is ill adapted for sorting, as the divisions are too capacious; it damages the music, lets in dust, and, above all, the pieces slide under each other in a maddening way too painfully familiar to need description. There are, it is true, Canterburies that take the form of cupboards for music, with duly panelled shelves. These are admirable when the quantity at hand is sufficient to fill them; yet they offer too much space for the average amateur, and too little for the professional or really rabid music lover, who, like his cousin, the bibliomaniac, knows no bounds to the appetite once it is acquired.

The structure herein to be set forth is for the lowest mean average—the possessor of, say, a hundred pieces of sheet music, more or less—and the problem to be solved: required, a conveniently placed receptacle, fitted to keep the music sorted into its several varieties—songs, dance music, pianoforte solos, duets, and so forth—readily accessible, and sightly enough in itself to add to the adornments of the apartment.

Of all mechanical methods of decorating wood, fretwork is, perhaps, the most general and the least exacting in its demands. No art knowledge is required; patient accuracy in each of its simple stages—in the tracing of the design, the sawing itself, and final polish—will produce work that is, so far as it goes, satisfactory and decorative.

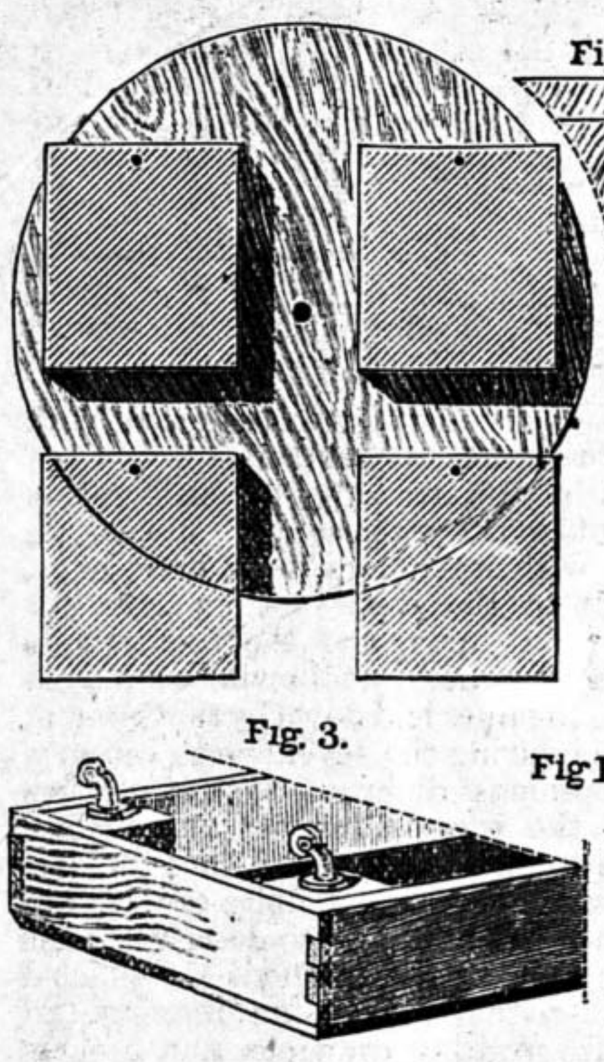


Fig. 10.

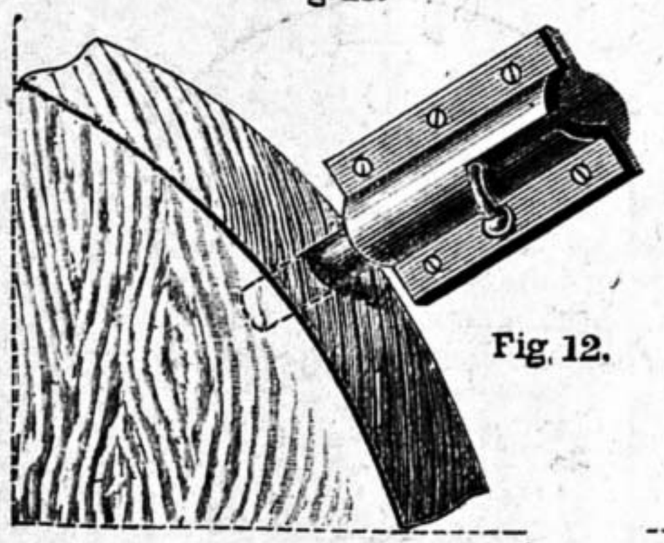
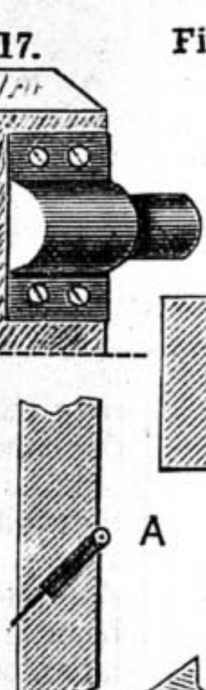


Fig. 12.

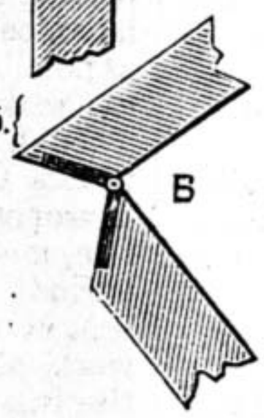
Fig. 3.

Fig 17.



A

Fig 15.



B

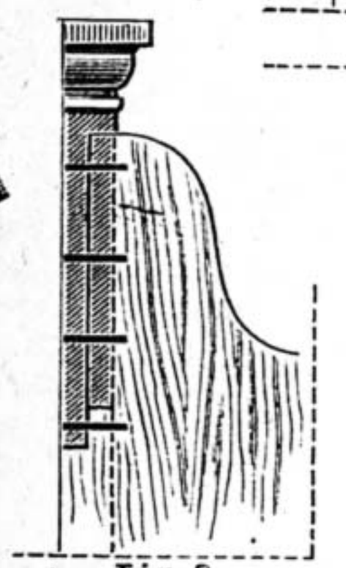


Fig. 8.

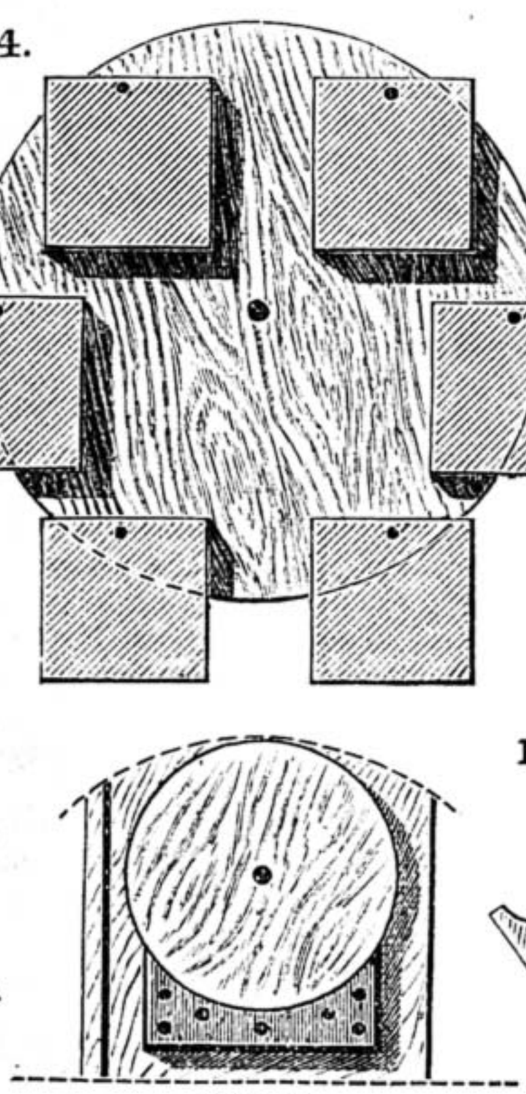
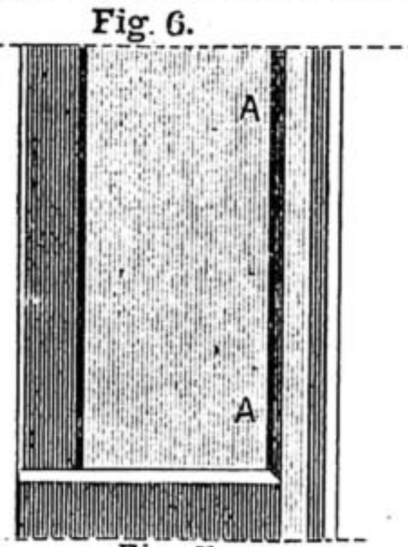


Fig. 6.

Fig 4.



A

A

Fig. 7.

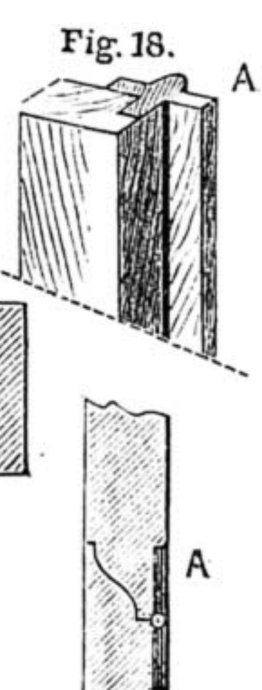
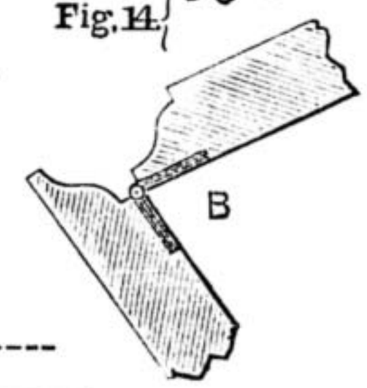


Fig. 18.

A

Fig.14.



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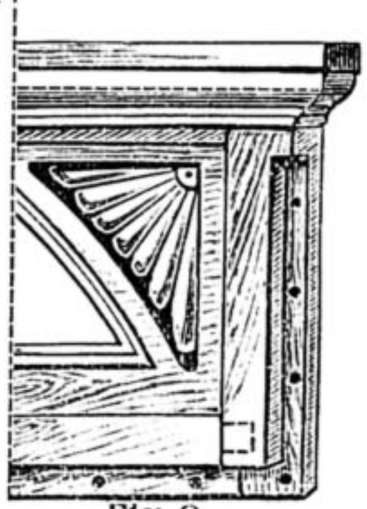


Fig. 9.

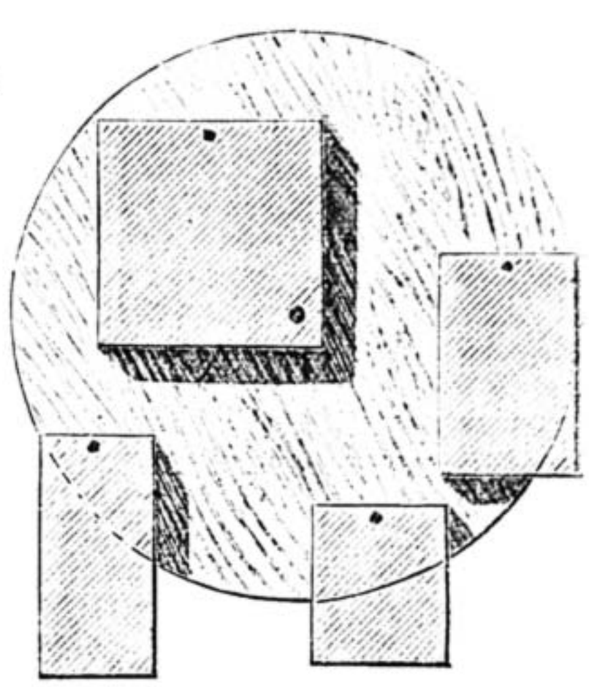


Fig 5.

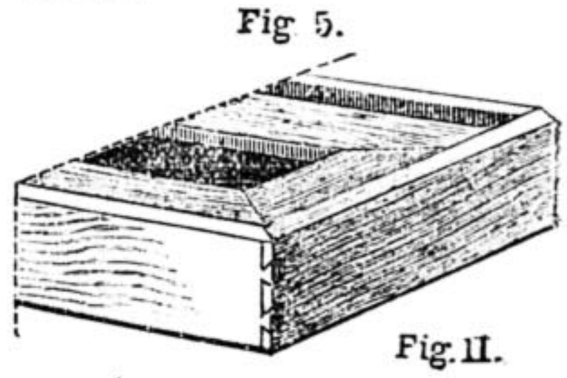
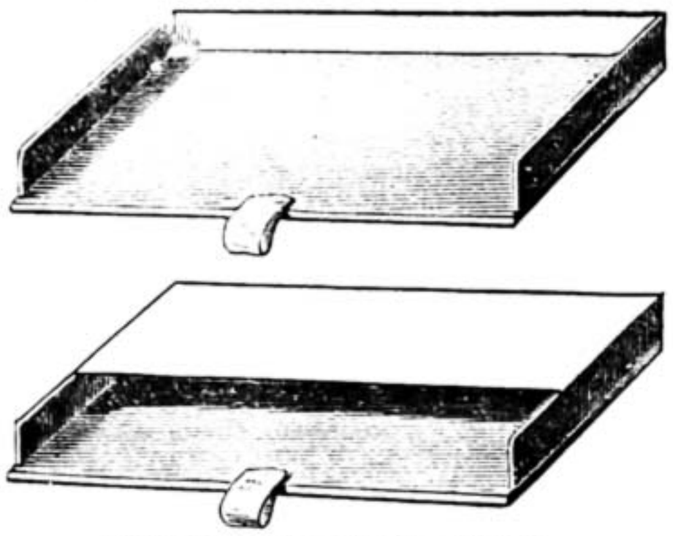


Fig. 11.

Fig 13

Like humanity, it has its faults—it harbours needless matter in the wrong place; but do not we, physically and mentally? It is spiky, and apt to be intrusive, catching in lace and dusters—easily paralleled in life. It is not so strong as it looks, and has dozens of those failings which an American humorist says he loves, because they make him feel a brother to every man he meets. If you go against its grain, it is short-tempered; if you go with it, it is obtuse; and so an excellent homily of mediæval style, full of laboriously trifling affinities, might be evolved, with some cudgelling of brains, from the much used, yet much abused, minor art dubbed fretwork.

For many reasons, in place of the usual Canterbury, a set of shelves to hang at a convenient height near the piano was thought to be more useful. If a violinist is a member of the family, they would, placed on the wall at a suitable height, support his music desk. In this way, the whole thing becomes a bracket with many shelves, and has space for bric-à-brac on the top one. When artificial light is used, such a place is likely to be more handy than the usual groping in one's own shadow at the ordinary Canterbury.



Trays or Drawers for Music.

Certainly, the old-fashioned article has an enlarged knife-box aspect, as though it were meant to be carried about. But, not to speak of its peripatetic use in crowded thoroughfares—which is absurd—did any one ever meet another so laden? My own notion is that it would break off at the first attempt to lift it from its native floor, while the absurd little quadruped, with its four dumpy legs in the air, would be a funny sight, even if it survived the unusual transit.

But why attempt a crusade against the unprotected and helpless piece of furniture? It is better to leave it to its friends, and introduce its would-be successor.

The weight of sheet music is not trifling. That so ephemeral a thing as the average modern song should be so heavy in bulk is astonishing. Yet, to make good its pretence to be worth two silver shillings, it must needs be on stout paper. Consequently, strength must be the aim, and the fretwork sides which support the whole weight should be cut out of wood—preferably three-ply wood—not less than a ¼ inch thick, and of fairly hard quality.

It will be seen that the design is planned so as to take shelves at a very short distance apart. If the size of the whole side piece is too large for the machine, the bracket portions may be cut separately, and fixed below the bottom shelf.

The top railing at the sides and back may also be cut in detached portions and fixed, as the brackets. In this case, the uppermost and lowest shelves should project slightly, and be finished with a moulding round sides and front.

It would greatly facilitate reference to its contents if false drawers or trays, of thin wood or cardboard, covered with cloth, as shown, were fitted to each recess. If preferred, these sham drawers might be developed into actual drawers, bearing each on its front the emblazoned legend of its contents.

But these additions will easily suggest and recommend themselves to workers according to their several needs. For instance, if the suggestion of its serving to support a music desk should be carried out, not only might a fretwork desk adorn its top, but brass candle sconces might be added at its sides.

For choice of wood, bearing in mind that some number of feet are needed, the most economical and effective plan would be to ebonise the whole, and thus allow common deal to be used for the shelves and uncut portions, or at best cheap mahogany.

Aspinall's enamel on fretwork is possible, if great care be taken in rubbing down the surface of the wood, using repeated applications of scalding water; and after each has thoroughly dried, taking off the grain which thereby swells up with fine glass paper, a good surface might be secured, on which the enamel could be used with a really good effect. How far a naturalistic painting of the leaves and fruit forms would be pleasant, I cannot say personally. In one out of a thousand persons who has an instinct for colour, it might be a delightful novelty; but I fear me that the nine hundred and ninety-nine would achieve an egregious failure.

Whatever its shortcomings, it is possible that the completed article will be found as admirable to those who may construct it as it has been to its creator.

THE VIOLIN: HOW TO MAKE IT.

BY J. W. BRIGGS.

INTRODUCTION—WOOD FOR VARIOUS PARTS—BELLY, BACK, RIBS, NECK AND SCROLL, BASS-BAR, SOUND-POST—BLOCKS—LININGS AND PURFLING—OUTSIDE AND INSIDE MODELS: HOW TO MAKE THEM.

Introduction.—A great writer on the subject has divided mankind into two classes—those who play the violin and those who do not. It is almost unnecessary to say that the violinists are in a minority; but if those who do not perform on this instrument continue to encourage those who do, there will be little cause for dissatisfaction.

It is not my purpose in these lessons to attempt to trace the origin of the violin—writers without number have used their pens for this purpose—but the fact remains that the instruments brought to a state of perfection never exceeded, if even equalled, came from the workshops of the Cremonese masters, and have earned for them almost immortal fame. The effectiveness of the violin, when handled by a competent performer, is so obvious that a person must indeed be devoid of all musical feeling who is not influenced thereby.

No matter what the theme—a rollicking jig or a sublime adagio—no instrument better fitted to give expression to the feelings has yet been invented. Its melodious strains may for a time be drowned by the blare of the cornet or the blasts of the trombone. Now and again the liquid notes of the flute or the oboe's plaintive wail may divert the ear of the listener, whilst the full and sweet melody of the clarionet is not to be ignored. The ear, however, soon becomes tired of these, although they add pleasing variety, and it is the violin alone which never becomes monotonous. In the orchestra it reigns supreme. To dwell further on the merits of this most fascinating instrument would only be too easy and congenial, but in a publication like WORK something more practical is

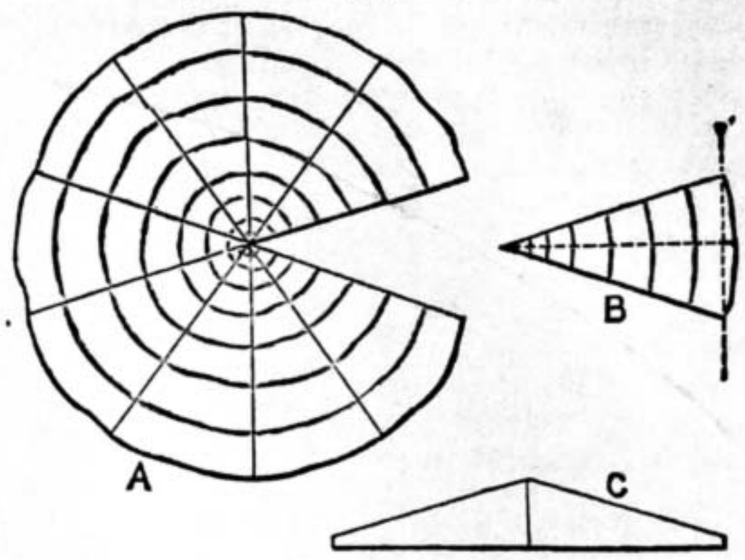


Fig. 1.—A, Section of Sycamore or Pine, cut on the quarter; B, Piece marked for sawing down; C, Ditto, jointed, ready for Use.

required. We will therefore proceed with the construction of our instrument.

It is a matter worthy of consideration that although the science of acoustics has kept pace with other branches of knowledge, the efforts of the great masters have not been improved upon, and the best results have been obtained by following as closely as possible the lines laid down by the Cremonese makers during the seventeenth century. Though opinions differ as to the relative merits of the various outlines and models, I propose to take for granted that the outline, measurements, and *f* holes of "Stradivarius" are the best, and to describe to the best of my ability the methods on which I work, and giving, as occasion requires, all the full-size working drawings, and a short

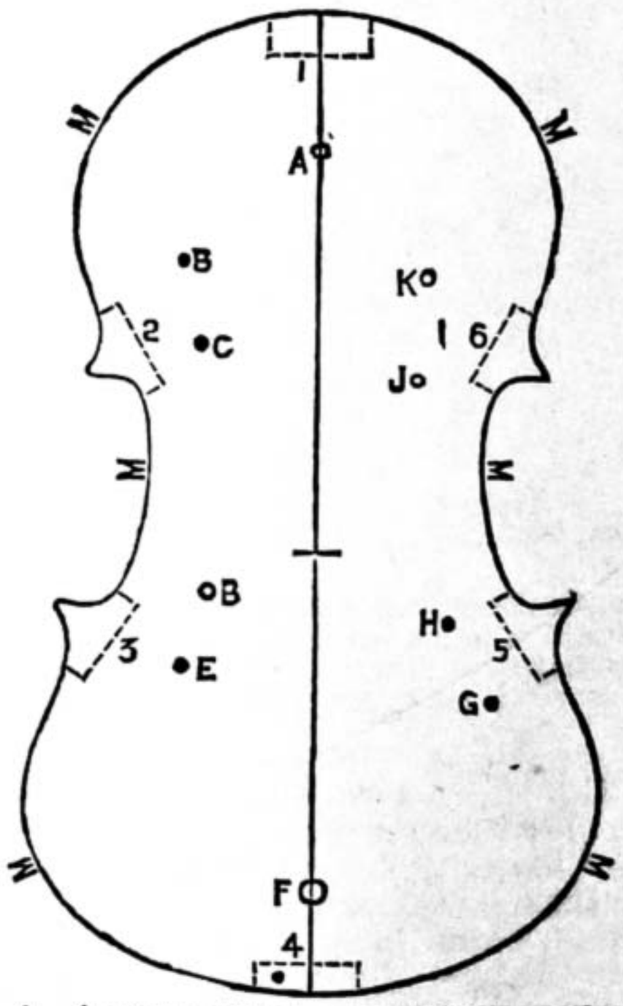


Fig. 4.—Appearance of Model Block ready for sawing out.

description of the tools specially needed when making a violin. I hope, in the pages which follow, to make myself clearly understood; should I fail to do so, it will be a pleasure to me to give, if possible, further explanation on any point which may seem obscure. There must, in dealing with a subject like this in a purely technical way, and free from all romance, be a danger of appearing

tedious; should this occur, I must plead my desire to be explicit as a sufficient excuse.

Wood for Various Parts.—It is most essential when setting about making a good violin that you have the very best materials from which to make it. Notwithstanding all the arguments in favour of artificially prepared wood, I am convinced that that which has been naturally seasoned is by far the best, and most likely to improve with age and use.

Belly.—For the belly we require a V or wedge-shaped block of clean, even-grained Swiss pine, 15 in. long by about 5 in. broad, 2 in. thick at one edge, and tapering to about ¾ in. at the other. This block should be cut on the quarter: this mode of cutting is shown in Fig. 1.

This gives the reeds or veins, which are portions of the concentric rings, running vertically through the wood in the direction of its thickness. The same result *is* also obtained by using the middle board, but in this case the two halves of either back or belly would not necessarily correspond in grain or in figure; and as we are going to work with a half pattern, from a centre line, let us have the wood cut as at B, Fig. 1. It is only when cut on the "quarter" that pine gives the beautiful mottled and silky appearance known as "flower."

The table from which the belly is to be made should, when jointed and planed true (as at C, Fig. 1), be ⅝ in. thick at the ridge.

Care should be taken when selecting this wedge to see that it has been "riven" or split, so that the fibres have run in their natural direction.

Back.—The back is generally of sycamore, cut also on the quarter: the stripes or bars in sycamore show at their best only when cut in this way. These strong bars or waves are termed the "figure." The piece for the back should be 15 in. long, 1⅜ in. thick at one edge, and about ⅝ in. at the other. Good back wood is very valuable, and the pieces are therefore cut so fine, that there is very little margin for waste.

Ribs.—The "ribs," or sides, are of sycamore, and may easily be purchased in strips, cut for the purpose, 15 or 16 in. long, by 1⅛ in. broad, and about $\frac{1}{12}$ in. thick. They should not require much cleaning up before being ready for use.

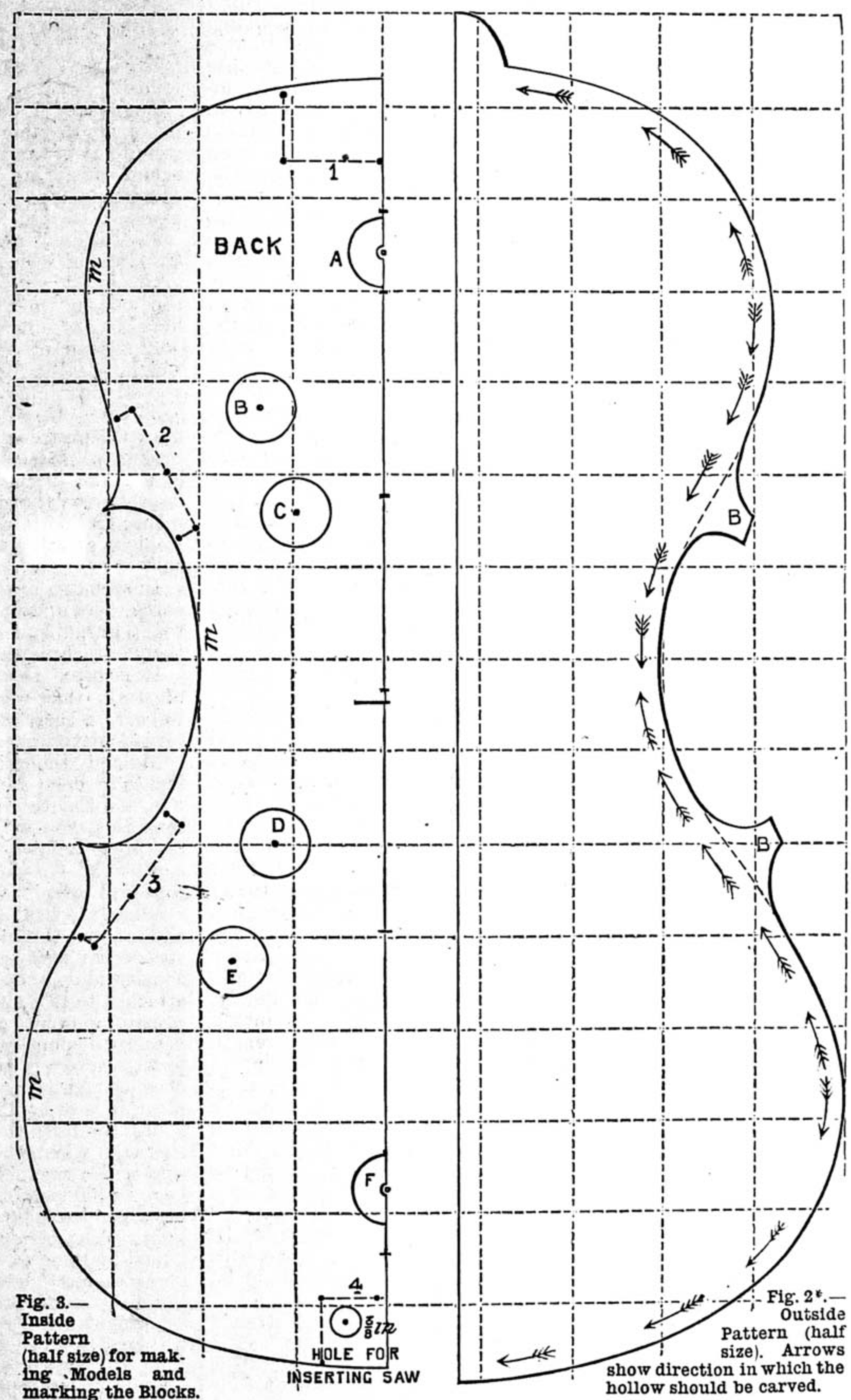


Fig. 3.—Inside Pattern (half size) for making Models and marking the Blocks.

Neck and Scroll.—To carve the scroll is one of the most difficult operations to be encountered when making a violin throughout; and as it greatly beautifies or entirely spoils (as the case may be) the appearance of the whole instrument, I think it would be better for you to buy a neck with the scroll already cut; but as some of my readers may like to try their hand, I shall give, as well as I can, instructions for doing so later on.

Bass-Bar.—The bass-bar is one of the most important parts of a violin, and on its dimensions and position depend to a large extent the tone of the lower strings. It is made of similar wood to the belly, and in the rough should measure 11 in. long by ¼ in. thick and 1 in. deep, the reeds running vertically through its depth and parallel the whole length of the bar. It should be placed parallel with the joint of the belly, under the left foot of the bridge.

Fig. 2*.—Outside Pattern (half size). Arrows show direction in which the hollow should be carved.

Sound-Post. — The sound-post is a round piece of fine-grained Swiss pine, ¼ in. diameter, and *about* $2\frac{3}{16}$ in. long. Its proper position (varying as it does in nearly every instrument) is difficult to determine; but it is usually just behind the right foot of the bridge. It should be just long enough to stand firmly before the violin is strung, and the grain should cross that of the belly.

Blocks.—These should be made of nice clean pine, an inch thick, from the middle board, if possible, as they will then be on the quarter, and will cut much cleaner. The grain runs vertically from back to belly. They are for affording support to the neck and end pin, for holding the ribs together at the corners, and to strengthen the fiddle generally.

Linings.—The twelve pieces of lining are put in to strengthen the ribs, and to give a greater gluing surface for attaching back and belly. They may be made from either pine or sycamore, and are $\frac{1}{16}$ in. thick and ¼ in. broad. I much prefer sycamore for linings, as it is not so liable to splinter when necessity arises to have either back or belly removed.

Purfling. — Purfling may be bought from violin makers or dealers at about 1d. per foot, and is generally made of two thin strips of wood, dyed black, with a strip of white wood between, the whole being about $\frac{1}{16}$ in. thick and $\frac{1}{12}$ in. deep. Some of the great makers used whalebone for making the black parts of purfling.

Outside and Inside Models: How to Make Them.—There are two ways in which a set of violin ribs may be put together: viz., inside an outside model, or outside an inside model. The latter is, I think, much superior to the former, being far handier and safer; but both models may be made from the same piece of wood, and with very little extra trouble. You should procure a piece

* To enable readers to furnish themselves at once with Full-size Working Drawings of all diagrams given half size, as Figs. 2 and 3, such diagrams have been divided into half-inch squares for enlargement on paper divided into inch squares. If any difficulty is experienced in dividing paper into squares for the purpose of making the enlargement, some of Letts's Sectional Paper on the scale required should be purchased.—ED.

of well-seasoned straight hardwood, as beech, birch, or sycamore, 17 in. long by 9½ in. broad at one end, tapering to 8½ in. at the other, and 1⅜ in. thick. Plane this piece perfectly true in length and breadth, and finish it 1$\frac{5}{16}$ in. thick at the broad end, tapered to 1¼ in. at the narrow end. Now make a line down the middle from end to end with a steel marker, or an ordinary bradawl sharpened to a fine point. Afterwards trace the line with lead pencil to make it more legible.

Cut out the patterns Figs. 2 and 3, in zinc or thin wood, taking care to have all the marks on Fig. 3 quite distinct. Place the pattern, Fig. 3 (which in future shall be called the "inside pattern"), exactly to the centre line on the block, and an equal distance from each end, and carefully, but decidedly, trace round the pattern with the marker, following with lead pencil. Then mark through the pattern the position of each block, as shown by the dotted lines in Fig. 3, and also the centres for the holes, A to F. Now turn the pattern over, and mark the other side in precisely the same manner; on the accuracy of this operation the ultimate balance of your fiddle depends. When ready to be sawn out, your block should bear every one of the marks which appear in Fig. 4. With a ⅜ in. bit bore the hole for inserting the saw. The models can now be cut out with a bow saw, but a much better plan is to get it cut at a sawyer's, with a "fret" or a "jigger" saw, making a cut of $\frac{1}{12}$th of an inch, and going exactly round the line, M, M, M, subsequently cutting out the recesses, 1, 2, 3, 4, 5, 6.

The edges of both models should now be trimmed up, which must be done by placing each of the models edgeways in a wood vice, and, using a file, one end in each hand, taking out all the small ridges which the saw has made, still keeping both models square to the side on which the outline was traced. Write distinctly on both models the word *back*: this will avoid much confusion that might otherwise arise. Next, with a ¾ in. bit, bore the holes, A to K. You should now square the centre line down each of the end block recesses 1 and 4, and with a straight-edge make another centre line the entire length of the other side of model. We now have two well-finished models (inside and outside); and before proceeding further, we had better consider the question of what tools we shall require. For this, however, we must wait for the next paper.

KNOTTING, SPLICING, AND WORKING CORDAGE.

BY LANCELOT L. HASLOPE.

INTRODUCTION.

ANTIQUITY OF ART OF KNOTTING—CORDAGE, TO WHAT APPLIED—LAYING FIBRES OF ROPE—YARNS—STRANDS—PRINCIPLE OF ROPE MAKING—RÉAUMUR'S EXPERIMENTS ON LAYING UP FIBRES OF ROPE—SIZE OF ROPE—CALCULATION OF STRAIN.

THE art of knotting has been said to be "probably as old as human fingers," and there is no doubt that mankind must always have used some kind of knot to join the sinews of animals, fibres of plants, or strips of hide that, in ancient days, formed a substitute for the endless variety of cordage in use in the present day. It is needless to enlarge on the importance of a knowledge of knotting, as hardly a day passes, even in private life, but we have to make a knot of some kind; and, of course, to the fisherman and seaman, whether amateur or professional, the subject is one of paramount interest. This being so, it seems strange that so little, comparatively speaking, has been written on the subject. I trust these articles will go far to remedy this defect, and to supply what I believe to be a real want. Even those of my readers who have not much occasion for working cordage will, I think, still find the subject an interesting one. They will be surprised to find what a large number of knots the skill of man has invented, many of them being highly ingenious, and capable of being used in various ways for decorative as well as useful purposes. The importance of being able to make a knot rapidly and correctly, and, at the same time, the one best suited for the purpose for which it is intended, cannot be over-estimated. Human lives, to say nothing of property, have over and over again been sacrificed to ill-made knots, and I believe there are few things of an ordinary kind that will better repay the trouble of learning than how to work cordage successfully.

The generic term cordage comprehends a vast variety of different kinds of rope, from the cable of a man-of-war to the fine "snooding" of the sea fisherman. It is also composed of a great diversity of materials. The most common substances from which it is made are hemp, flax, cotton, manilla, and coir. It is outside our present purpose to go into the process of the manufacture of rope in anything like detail, but the succeeding pages can hardly be fully understood without some knowledge of the construction of cordage; I shall therefore give a few particulars as to the various parts that form a rope.

If the fibres of which a rope is composed were laid parallel to one another and fastened at the two ends, the combined strength of these fibres would be better utilised than by any other means—in other words, they lose strength by being twisted or "laid up." But, on the other hand, the length of the fibres being at most but a few feet, their utility in this state is very limited, to say nothing of the inconvenience of using them in this way. To obviate this difficulty, the fibres are first twisted into "yarns;" these, again, are laid up into "strands," a strand being formed of several yarns; and, finally, three or more strands are formed into a rope. As I have before said, the strength of a rope is diminished by the twisting of the yarns, and this being the case, it is important the yarns should be very carefully laid up, so as to bring an even strain on every part. This should be borne in mind when rope is chosen. It should also not be laid up too hard—that is, it should only have sufficient twist in it to prevent the fibres from being drawn out without breaking; anything more diminishes unnecessarily the strength of the cordage, and should be avoided.

Ropes are generally made of three strands laid right-handed, or "with the sun," as it is termed aboard ship. They are then called "hawser-laid." If they are made of four strands laid right-handed, they are termed "shroud-laid." A cable-laid rope is made of three hawser-laid ropes laid up left-handed; it therefore contains nine strands. It will be seen from the foregoing that the size of a rope is regulated by the quantity of yarns that compose the strands, and not by the number of strands that it contains.

The principle of rope making is very readily shown by holding the ends of a piece of twine or whipcord, about a foot long, in each hand and twisting it so as to increase the lay. If the twine be now slackened by bringing the hands nearer to one another, a loop will first form in the middle of the twine, and it will continue to twist itself up into a compact cord which will not unlay, as the tension to which the strands have been subjected causes friction between them, which holds them together. In other words, the tendency of each part singly to unlay, acting in opposite directions, is the means of keeping them together when joined.

Some very interesting experiments were made by Réaumur, the purposes of which were to ascertain the loss of strength occasioned by laying up the fibres of various substances, one or two of which I shall give.

1. A thread, consisting of 832 fibres of silk, each of which carried 1 dram and 18 grains, broke with a weight of 5 lbs., though the sum of the absolute strength of the fibres is 104 drams, or upwards of 8 lbs. 2 oz.

2. A skein of white thread which bore a weight of 9 lbs., when twisted into a cord of two strands, broke with 16 lbs.

3. Three threads were twisted together, their mean strength being nearly 8 lbs. It broke with 17½ lbs., whereas it should have carried 24 lbs. These experiments abundantly prove that though we gain in convenience and portability by twisting the fibres, we lose greatly in the strength of the resulting rope.

In speaking of the size of a rope, the circumference and not the diameter is alluded to. Thus, a three-inch rope would be less than an inch in diameter.

It is often required to know the amount of strain that we may fairly expect a rope to bear. I therefore give an useful formula for calculating it.

Multiply the circumference of the rope in inches by itself and divide the product by five, and the result will be the number of tons the rope will carry. For example, if the rope be five inches in circumference, $5 \times 5 = 25 \div 5 = 5$, the number of tons the rope will carry.

When the strain that a rope will bear is alluded to, it must be understood that a steady haulage is meant, for if the strain comes suddenly on a rope, as when a weight attached to it is allowed to fall suddenly, its resisting power is greatly diminished. This is easily demonstrated by giving a sudden jerk to a piece of twine, when it will part at once, though all one's strength, steadily applied, fails to break it. Knots always more or less diminish the strength of a rope, particularly when they are badly made; so that where as much strain as the rope will bear is likely to come upon it, care should be taken to use none but the strongest knots. The Alpine Club, in the report issued by them of some experiments made on ropes, recommend for joining two ropes the fisherman's knot, and for loops the fisherman's eye.* Probably these knots will bear as much strain as any.

If we require to know the weight of any description of cordage, we can ascertain it, if hawser or shroud-laid, by multiplying the circumference of the rope in inches by itself and by the length of the rope in fathoms, and dividing by 420; the result will be the weight in cwts. For example, to obtain the weight of a six-inch rope 120 fathoms long, $6 \times 6 = 36 \times 120 = 4{,}320 \div 420$, makes the weight of the rope 10 cwt. 1 qr. 4 lb.

* Illustrations of these knots will be given with subsequent papers, and will be found, the former in Fig. 14, and the latter in Fig. 16.

The rule for cable-laid rope is somewhat different. In this case, multiply the circumference in inches by itself and divide by four; the product will be the weight of the rope in cwts.

In practising knotting it is as well to use a tolerably firm material, such as whipcord, for small common knots, or, still better, small fishing line—of course, I mean line used for sea fishing. Either of these can be tied up and undone over and over again without injury to the stuff, which is not the case with twine; it is also more easy to see which way the parts of a knot lie in the harder material, and then to find out whether the turns are properly made or not. In the case of more complicated knots, particularly those where the strands of the rope have to be unlaid to form the knot, such as a wall knot or a Mathew Walker, I should advise that three strands of fishing line be used, about a foot long each. If a seizing be put round them in the centre, so as to hold them firmly together, we have a good representation of a rope with the strands unlaid ready for working. A knot can be made and unmade as often as required in this way, without the strands suffering any detriment, which is not the case with the strands of a rope, which, from their loose nature, will seldom bear knotting more than once or twice. I have adopted this plan myself with great success in making the illustrations for these articles. If desired, the knots can be made as above described and kept for future reference. In string also it is better to use hard laid stuff at first, but when these matters are thoroughly understood, knots can be made on any sort of cordage without difficulty.

HOW TO STROP A RAZOR.

BY P. B. H.

A FEW years ago I could never keep a strop for a longer period than about nine months, as, during that time, it got so cut up that it was, comparatively speaking, worthless. A kindly hint from a friend some five years ago saved me a deal of expense in strops, as, since then, I have used the same one, and there is now only one cut in it, which was made when quite new, just before the hint was given.

As I am certain a few hints on this subject will be useful to some of the many readers of this journal, I shall endeavour to enlighten them by the following description and sketches.

The regular strop is a flat piece of wood about 1½ in. wide by 12 in. long, with a handle cut out at one end. This wood, with the exception of the handle, is covered on both sides with leather about ¼ in. thick. The surface of the leather of the one side, being covered with some sharpening composition, generally flour of emery, is dark. This side should always be kept moist by every now and again adding a drop or two of oil, and, at greater intervals, a little flour of emery, in order to keep up the sharpening properties. The other side is simply of plain smooth leather for finishing off the razor after being sharpened on the first side.

The method of procedure is as follows:—Raise the strop slightly by placing the end on its case (as shown in sketches), or any other convenient object, so that a complete stroke can be given to the razor. Then, with the dark side uppermost, and the razor in the position shown at B in Fig. 1, draw it upwards, and, at the same time, across the surface of the strop till it takes the position C (Fig. 2).

As on the turning of the razor at this point depends whether the strop is cut or not, care should be taken to follow the directions carefully. There is a great

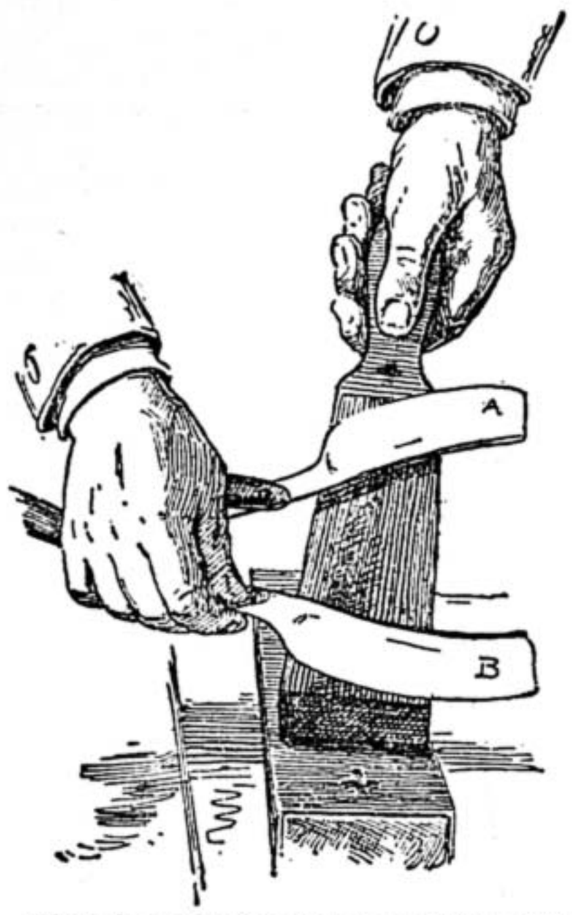


Fig. 1.—Showing commencement of Down Stroke (A) on Strop, and commencement of Up Stroke (B).

temptation to lift the razor bodily from the strop at the end of each stroke and turn or reverse it with the cutting edge pointing downwards, which is the principal cause of the strop being cut. The turning should be done at the end of the upward and downward stroke *on the back* of the razor, which should never leave the surface of the strop. During the reversing the razor should be slid sideways on the strop so that the heel rests on it, as at A (Fig. 1), ready

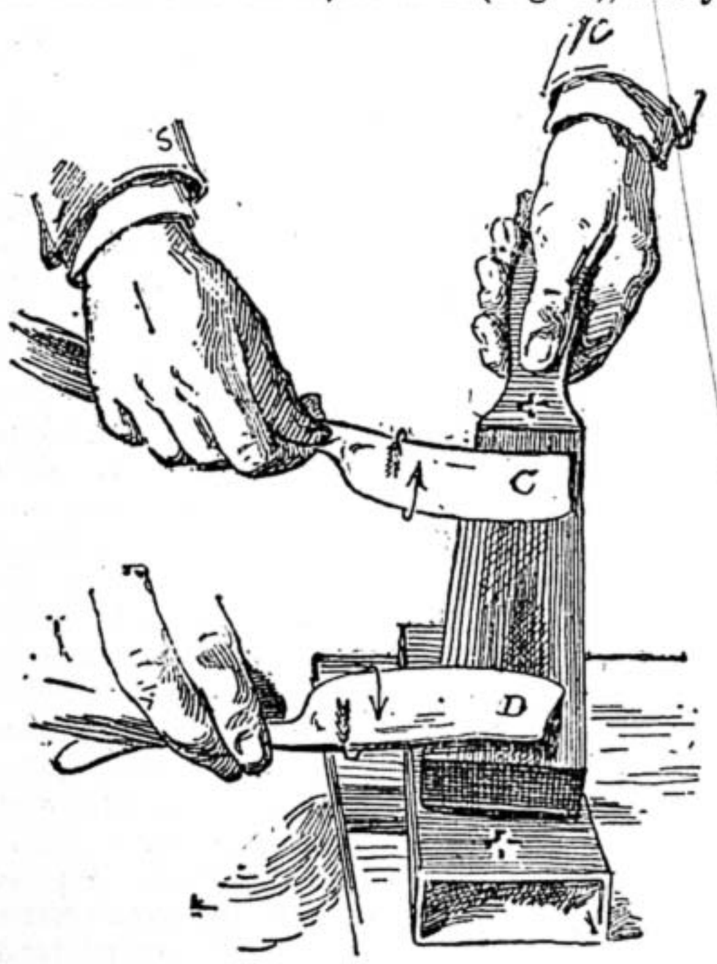


Fig. 2.—Showing completion of Up Stroke (C) on Strop, and completion of Down Stroke (D).

for the downward stroke, which is performed as above; the razor at the end taking the position D (Fig. 2), ready for turning in the direction of the arrow, at the same time being pushed forward till it takes the position shown at B, the position from where we started. The blade should never completely leave the strop. After a few strokes upwards and downwards, the strop should be reversed, and the same process performed on the smooth side, when the razor should now be found fit for use. The razor should be held perfectly flat on the strop during the operation. Another great point, in keeping a razor in good condition, is to dry it well with a towel immediately after use, and then draw it a few times over the smooth side of the strop. This takes off any moisture before putting it away. On every good strop and case there is some distinguishing mark to show which way the strop should be put back. I have shown a cross in my sketches. Care should be taken that these two marks always coincide—that is, that the dark side of strop, when put in the case, always touches the one side; otherwise the clean smooth surface of the strop will get emery on it, which will be very detrimental.

WIRE-WORK IN ALL ITS BRANCHES.

BY JAMES SCOTT.

INTRODUCTORY—CRIMPING AND ITS INVENTOR.

BY the courtesy and practical knowledge of a particular friend, I am in a position to lay before my readers details of a trade different and distinct from that which for many months past I have been permitted to represent.

As most of my readers will doubtless be aware, I have striven my best to give them designs of folding and combination furniture, which, in many cases, I am glad to understand, have met with approval. In making public these designs I have not tendered any excuse for my conduct, nor attempted to defend myself against the friendly, yet unpleasant, accusations of trade acquaintances, who have made remarks to the effect that I have been influencing the trade in a wrong direction, for a certain extent, by giving these designs to the amateur; for the designs being original, I asked neither any body or any thing, except my own conscience, as to what purposes I should place them to; and I have no cause to regret that, with the permission of the Editor, I have given them to the readers of WORK.

But as I am entering upon the description of a trade, for correct particulars of which I must rely upon and be indebted to my above-mentioned practical friend, I feel that I must say a few words upon this question of amateur *v.* professional. My worthy fellow contributor, Mr. Clarkson, has mentioned in his articles upon "Bookbinding" (see page 69, No. 57, Vol. II.) that these two classes will never clash, and I firmly believe that as *classes* they never will; but it is an undeniable fact that in many instances members of one or other of these two classes look with contempt, distrust, and very often, I regret to say, hatred, upon the members of the opposite class.

This should not be. WORK is a magazine which has been established for the benefit of both bodies, and I am pleased to believe that, through its instrumentality, each body is beginning—in fact, has already begun—to look with a friendly and favourable eye upon the other body.

It is rather late for me to make these remarks concerning WORK's mission, but, as I before hinted, I have never taken the opportunity of saying anything of this nature before, for the simple reason that such might have been construed into an

excuse on my part for giving designs to the amateur in my professional capacity.

As an illustration of the harmlessness of the average amateur, I will take an instance from the articles I propose giving under the title of "Wire-Work." Let us suppose I have placed these details before the readers in a plain, straightforward, under-

Fig. 1.—Wire as crimped in Machine.

standable manner (and I am sincere in saying that I trust I shall do so), and that an amateur has grasped sufficient instruction to enable him to make, say, a pair of wire baskets for himself, and that he has decided to make them. Will he not require the material preparatory to the making of the baskets? and will he not have to purchase that material from the wire trade? Certainly. Then whence comes the supposed detriment this inoffensive amateur has created? "Why, from the fact that he is about to make

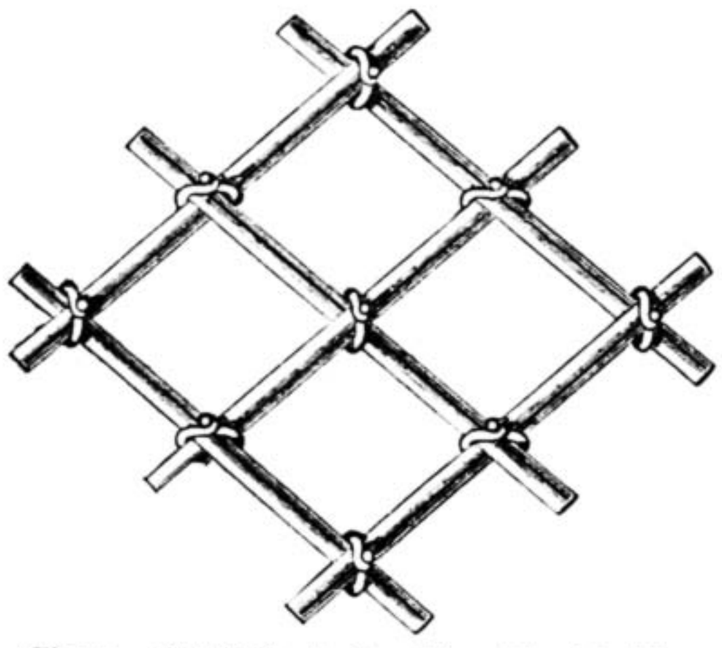


Fig. 2.—Old Method of making Wire Trellis.

articles which he should purchase already made, and thereby encourage industry," I fancy I can hear some disgusted wire-worker murmur.

Now, what does encouraging industry mean? I hide behind common-sense when I say that if people buy what they *want* they are pleasing themselves, and have not the encouragement of industry as their motive. But if they purchase what they do not particularly require, but *may* make *use* of, then they *are* encouraging industry.

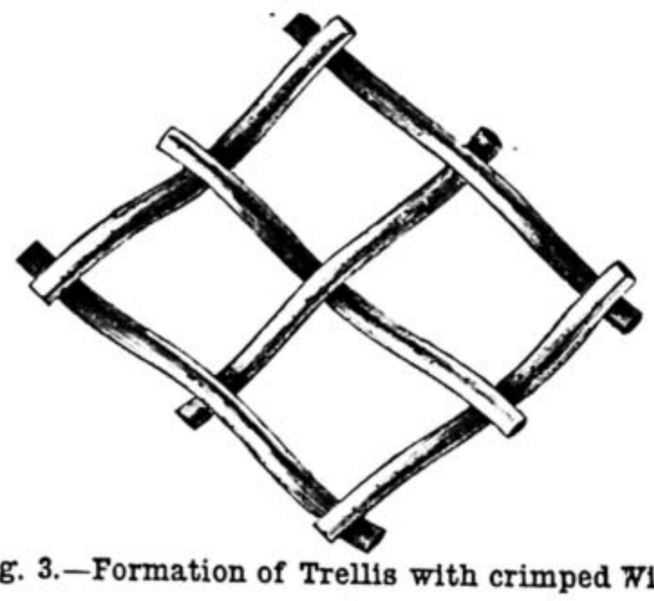


Fig. 3.—Formation of Trellis with crimped Wire.

But this practice is no more to be commended as a stimulus to trade than the purchase of goods at a bazaar—both are but species of charity.

Now, it is a fact that the amateur I am taking as an example may never have dreamt of having a pair of baskets previous to reading my article upon that subject, although he may have seen hundreds during his lifetime; he may make them because he finds pleasure in such work, but when he has made them and exhausted the pleasure of so doing, he will not destroy them, but will find further pleasure in their possession.

The result, then, is that the much abused amateur does not harm any trade he may select to work occasionally at, but, on the contrary, does good to it—very little, perhaps, but still the fact remains.

Then, am I only going to give these details in order that, perhaps, a few amateurs may gain sufficient insight to enable them to while away an hour or so now and again? I don't know. What blissful ignorance! I am going to tell my readers all that my friend tells me and explains to me by experimental lessons. I do not suppose the professional wire-worker to gain much benefit, but I do hope that young beginners in this trade will find my remarks of assistance, as being supplementary to their master's instructions; and I do also hope that many amateurs may experience pleasure from this trade as well as from others.

Many who are in the Birmingham wire trade will remember with respect the name of Mr. Thomas Bellamy, who quitted this life some years back, and who was the inventor and patentee of the crimped or corrugated wire now so extensively used in many branches of wire-working.

His invention consisted of crimping, by aid of machinery, wire intended to be placed together to form fences, garden borders, hen coops, fire guards, etc. The old method of making such things was that of placing the wires over and under each other, and then securing them at their junctions by means of tying with pieces of wire. The amount of labour this process entailed can be imagined by the examination of a piece of work so made, or "put together," as it is technically termed. To simplify matters, Mr. Bellamy stirred his inventive faculties, with the result that he was deservedly enabled to considerably increase his business and his fortune by patenting his ideas.

One end of a coil of straight wire (this sentence sounds somewhat paradoxical and Irish, but my meaning will be conveyed)—one end was put in his machine and drawn through it, coming out at the other side crimped as shown in Fig. 1 and various other diagrams. This was then cut up into the required lengths, which when put together across each other in the same way as the old method, were held together by their own unison, requiring no ties at the junctions, as did the former pattern. After being fitted into their frames, they were as firm and more artistic (if I may be permitted to use the expression in this direction) than were the straight wires. The amount of labour saved by this invention was simply enormous. Whether this fact was beneficial to the trade workers or no I will not venture to discuss, but, in the belief of a notable theologian, who wrote to that effect some time ago in a weekly magazine (which I will not name, for fear of being accused of attempting to advertise), machines are commendable in every trade, by reason of *creating* labour in the particular trades wherein they are introduced, and also in others. In Figs. 2 and 3 are shown the old method and the crimping method respectively.

Various members of Mr. Bellamy's family are still in the same trade, although they have left their native town and are scattered in different directions, and it is to one member to whom I am indebted for my present facilities of giving the following instructions.

I shall arrange the descriptions under two heads—viz., "Plain and ornamental wire-work," and "Wire-work in conjunction with metal mouldings and wood." The first part shall contain explanatory details of the construction of such articles as fire guards, pea guards, rat traps, fences, hen coops, baskets, gas globes, etc., which are composed solely of wire and iron rods; while the latter part will consist of the descriptions of such things as cages, sieves, dish covers, fenders, etc., with which metal mouldings and wood are usually connected.

FIXING TOPS OF TABLES.

BY H. HINGE.

In making tables for kitchen, dining-room, and all kinds that have any size about them, it very often happens, after all precautions have been taken with the wood that forms the top, in a little while the joints break and open, and what was once a good job now becomes an unsightly thing. The cause of this disaster, of course, is the wood not being dry. What is dry? It has been proved by experience that wood which has been cut years and jointed to form a large top, when it has been in a warm kitchen it has

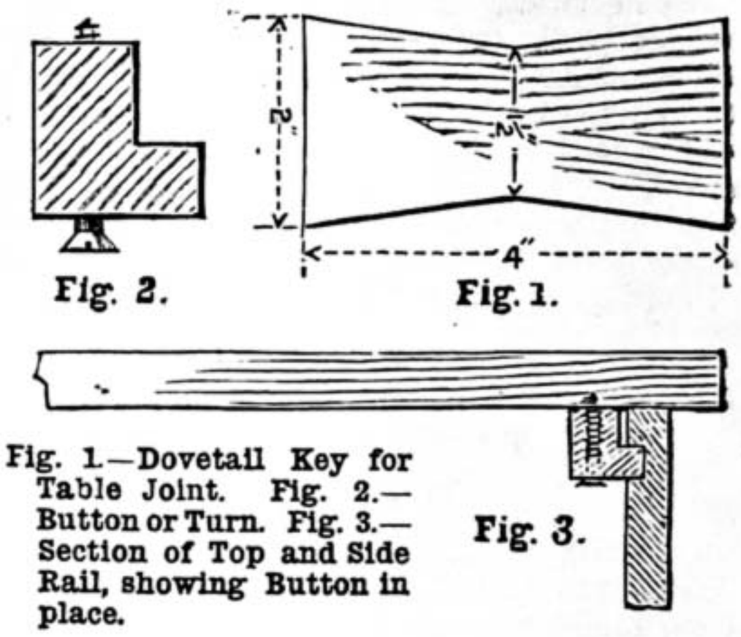


Fig. 2. Fig. 1.

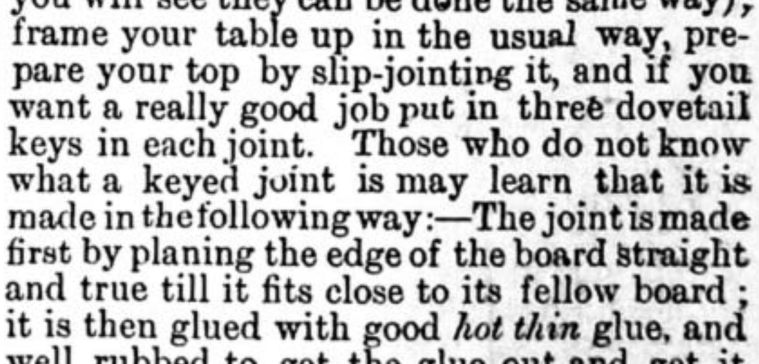


Fig. 3.

Fig. 1.—Dovetail Key for Table Joint. Fig. 2.—Button or Turn. Fig. 3.—Section of Top and Side Rail, showing Button in place.

"gone," the workman has been blamed, and the wood called anything but good. Different ways have been tried both in jointing and fixing the top on, but the following method is one which will allow a top to shrink or go any way without breaking the joints or the top becoming unlevel:—Before the table is framed together, get the rails which go into the legs, and placing them on your bench top edge towards you, inside up, with a plough and $\frac{3}{8}$ in. iron, cut a groove from end to end. There should be about $\frac{3}{4}$ in. of wood clear on the top edge before the groove commences. Serve all your rails like this (if you have any drawer rails in your table, you will see they can be done the same way); frame your table up in the usual way, prepare your top by slip-jointing it, and if you want a really good job put in three dovetail keys in each joint. Those who do not know what a keyed joint is may learn that it is made in the following way:—The joint is made first by planing the edge of the board straight and true till it fits close to its fellow board; it is then glued with good *hot thin* glue, and well rubbed to get the glue out and get it close. After having stood, say ten hours, to set, some keys are made out of $\frac{3}{8}$ or $\frac{1}{2}$ in. oak or mahogany, say 4 in. long, shape of Fig. 1. One of these is then "let in" flush with the top on the under side about 4 in. from the end. Of course, they should fit well on the sides, but a little liberty at the ends is preferable. These are glued in, and when dry, levelled off; in long joints it is necessary to

put in three, four, or five, according to length of top. It is generally acknowledged that this is the best joint for woodwork where practical, having the advantage over all joints which are dowelled or tongued, it being so much easier to get a good close joint. To fasten on the table-top, make, say a dozen, hardwood buttons or turns (Fig. 2). These should be made 1½ in. long out of 1 in. stuff, and notched so that they will fit in grooves in the rails, and room left for a screw to go through into the top. When fixed, which is done by placing the table-top on your bench under side up and putting the frame on the top of it legs up, and placing your buttons into the grooves, send a screw through the other end. Fig. 3 is a section of the side rail, showing the button in its place. It will easily be seen that a top fastened down in this manner can move along the grooves as the wood dries without either warping or breaking the joints and still be fastened down. This method will commend itself at once for many things which require to be held firm and yet allow the wood to shrink for amateur and all kinds of workmen.

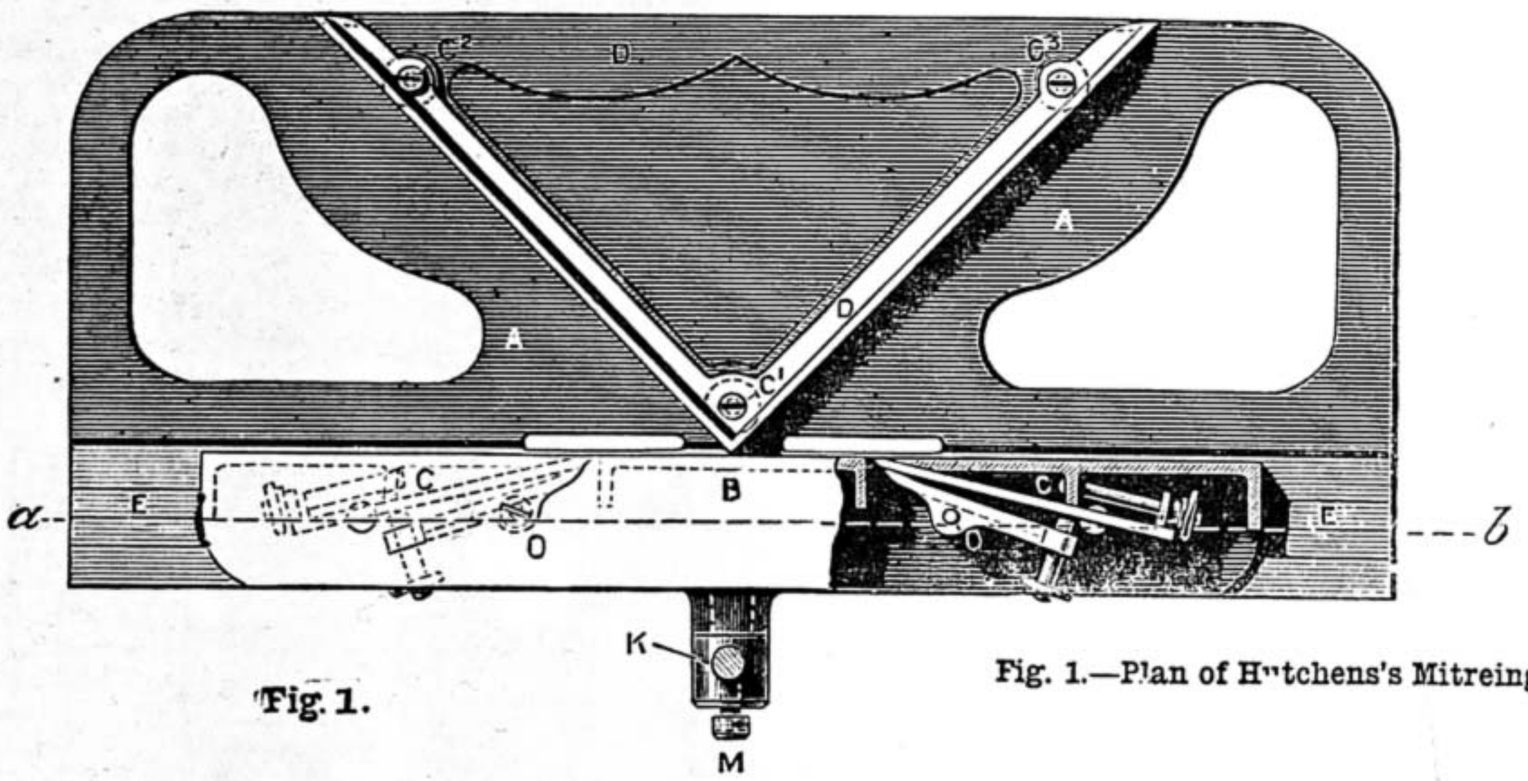


Fig. 1.

Fig. 1.—Plan of Hutchens's Mitreing and Squaring Machine.

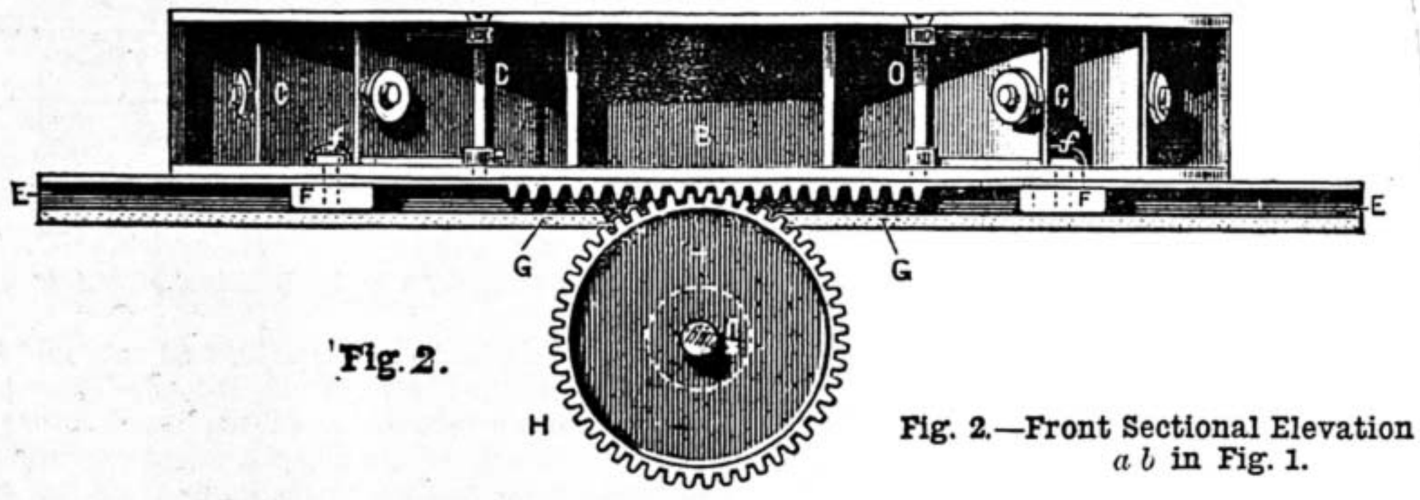


Fig. 2.

Fig. 2.—Front Sectional Elevation on Line *a b* in Fig. 1.

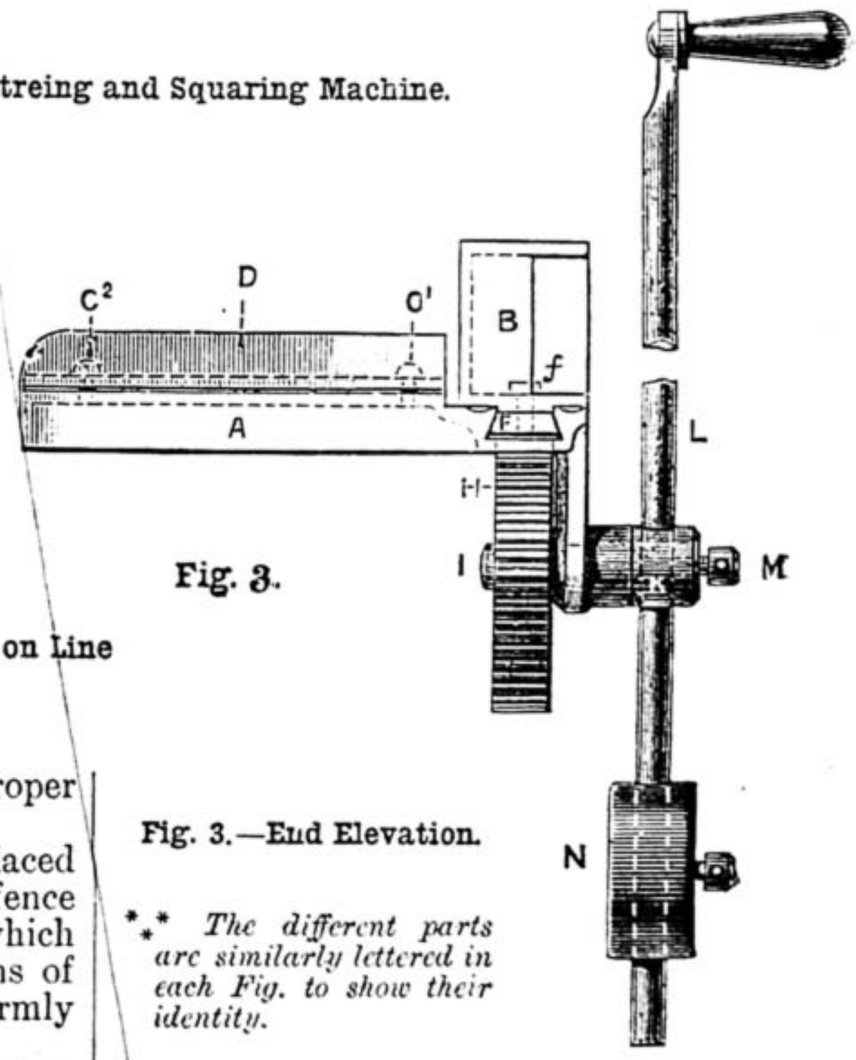


Fig. 3.

Fig. 3.—End Elevation.

*** *The different parts are similarly lettered in each Fig. to show their identity.*

A NEW MITREING AND SQUARING MACHINE.

BY A "CONSULTING ENGINEER."

I HAVE lately had the opportunity of inspecting a very simple and efficient machine for the above purposes, which has been invented by Mr. Wm. Hutchens, of Penzance, who has applied for and obtained a patent for the same.

The machine consists of a metal bed or sole plate, which supports and carries the working parts and the material to be operated upon, and which is, or may be, placed or supported on a suitable stand at the height most convenient for performing the work. The working parts consist of a movable plane or part of metal or other suitable material, which works on the bed or sole plate over a guide or groove formed therein, which is so arranged by means of suitable cutters as to cut or plane whilst moving in either direction. The cutters are provided with suitable means for regulating and adjusting the depth of cut, and readily removing and replacing them for sharpening or other purposes. On the under side of the moving part to which the cutters are attached a toothed rack is formed, into which a toothed sector or pinion wheel gears. This sector or pinion works on a short horizontal shaft or stud, to which a partially rotating or vibrating movement is given by means of an adjustable lever, and a projecting part or parts on the under side of the part containing the cutters fits into the groove or guide, and so keeps it, when in motion, in the proper position to do the work.

On and to the bed or sole plate is placed and attached the adjustable guide or fence which regulates the angle or bevel at which the material is to be cut, and by means of set screws it may be adjusted and firmly held in the required position.

In the accompanying engraving, Fig. 1 is the plan, Fig. 2 a front sectional elevation on the line *a b*, and Fig. 3 an end elevation, the like parts in each being denoted by the same letters of reference in each Fig.; A A is the bed or sole plate; B, the movable part containing the cutters and arrangements for fixing and adjusting the same, shown where the upper part is broken off; D, the adjustable fence or guide, and the screws, C^1, C^2, C^3, for holding and adjusting the same, which, when set square with the face of the plane or moving part, enables the ends to be squared; E, the groove or guide in which the projections or parts on the plane, or part B, work; F, F, the separate parts, projections, or pieces which work in the groove or guide E, and the screws *f*, *f*, which hold the same in place; G, in Fig. 2, shows the rack on the under side of B, into which the pinion quadrant or sector H gears; I, the horizontal shaft or stud on which the part H is attached; K, socket on end of shaft through which the adjustable lever L passes, and is fixed by the set screw M. The adjustable counterweight and set screw are shown at N in Fig. 3. The parts on which part of the arrangements connected with the cutters work are shown at O, O in Figs. 2 and 3.

By the use of this machine, mitres of 10 in. by 5 in. have been shot with the greatest ease, and it will work on the smallest sizes of material with as much facility as on the larger. It is made in several sizes, to suit the demands of customers, and has been awarded two silver medals at the Falmouth and other exhibitions in the West. The prices, complete, are very moderate, and vary from £5 10s. each, according to the sizes of the machine. It is so arranged that narrower or wider irons may be used in each machine, and it can be seen and tested at Messrs. Engert and Co.'s Picture Frame and Moulding Factory, 75, City Road, London, E.C. I can safely say that it is such a machine as ought to be in every workshop where mitreing of any kind has to be done, as it will quickly repay its cost by the superiority of the work done and the speed and convenience with which it may be carried out. Its utility is obvious, and without doubt it will very soon come into general use.

HOW TO FRENCH POLISH.

BY DAVID DENNING.

FULL directions for polishing furniture and other woodwork by means of waxing and oiling having been already given, no doubt there are many readers who will welcome the appearance of directions for the more difficult process of French polishing, by means of which the highest possible gloss may be given to suitably prepared wood. At the outset, let it be said, for the benefit of some, that varnishing and French polishing are by no means the same. The one can be done by any person with little or no practice, and is not suitable for any but the commonest articles of furniture, the other cannot be done properly without considerable practice and care; but when skilfully

managed, it enhances the beauty of nearly all kinds of wood. If badly done, it is often rather a blemish than otherwise, so that the beginner, if he be wise, will not attempt to polish anything of value till he has gained some little experience by practising with comparatively unimportant articles. I do not want to discourage amateurs and novices, but it would be only a false kindness to tell them that they can at once proceed to polish well by attending to instructions. However clearly these are given, they cannot give the knack and experience, which can only be gained by practice. Many beginners, I am aware, labour under the mistake of supposing, because they cannot get the same beautiful polish that is seen on the best furniture, that there is something wrong, either with the stuff they are using, or with their method. Without saying that one or the other, or perhaps both, might not be capable of improvement, the defects are probably principally owing to want of practice. The disappointment, no doubt, is somewhat emphasised by having noticed the easy—not to say lazy and seemingly effortless—way in which an experienced polisher brings up the brilliant even gloss. As a matter of fact, French polishing, like playing the fiddle, is not difficult when the knack has been acquired; but this cannot be got at once. The actual directions may no doubt help towards success; but they are unable to do more, and though every effort will be made by the writer to omit nothing of importance, it is quite impossible to foresee every trifling difficulty which individual readers may encounter.

To a certain extent, the polisher's calling has, perhaps, suffered in the hands of amateurs and novices, who have not had opportunities of learning in a practical workshop by the amount of mystery which sometimes seems to enshroud it. To practical polishers, the complicated recipes for stains, polishes, etc., which are often published for the benefit of the amateur seeking information, are a cause of wonderment. They are among the things not generally known in the workshop, but as many of them are elsewhere vouched for, they may be admitted on due report of being useful somewhere.

The ingredients of the various preparations are generally few and simple, and success certainly does not necessarily lie in complication and multiplicity of mixtures.

Although it may be said that, roughly speaking, each kind of timber requires different treatment, the general manipulation is very similar for all. In the main, it consists of coating the wood with a thin film of shellac, either pure or in mixture with other gums and resins, and getting a gloss on the film as brilliant and durable as possible. Before this can be done the wood generally has to be prepared, and various other minor details attended to. For example, the grain, or rather the pores, of open grained wood must be stopped, or, as is generally said, filled, to get a perfectly smooth surface, and to prevent the excessive absorption of the liquid polish. Then there are some woods the appearance of which is improved and enriched by oiling them before applying the polish. This, to a certain extent, darkens them, giving a mellow look, and, as is said, brings up the figure. The different treatment of the ordinary furniture woods will be named in the course of future papers; at present only general treatment can be dealt with. The place in which French polishing is done, or rather the temperature and atmosphere of the place, are of considerable importance. The work cannot be done properly in a cold damp room or outhouse. Warmth especially is absolutely necessary, so that a room which will do well enough for ordinary manual work may not do for a polishing shop. If the place is too cold, the polish as it sets on the wood gets chilled, and becomes more or less opaque and cloudy-looking. Slight chill may, to a certain extent, be cured, but the best way is to avoid it altogether by working in a warm room. By way of forestalling possible inquiries addressed to "Shop," I may as well say that I cannot tell what the minimum temperature should be, and I expect very few polishers could. As a rough guide, it may be said that an ordinarily comfortable temperature of a living room is about the thing. During warm summer weather a fire is not necessary, in the winter time it is. For the rest, if the polisher notices that his polish "chills," he must increase the heat of his room. As chill will sometimes happen in the best regulated shops, it may be satisfactory to know that if as soon as it is observed a moderate amount of warmth be brought near the surface the chill will probably disappear almost directly. A small article, of course, may be taken to the fire, but with anything large this course would naturally be inconvenient. A good plan in such cases is to hold something warm a short distance from the chilled surface, but on no account must it be allowed to touch, or the heat be great enough to burn, the polish. A common plan, but not altogether a good one, for obvious reasons, is to hold a piece of burning paper near the chill. Another cause of chill is from the article being polished being too cold or damp. It is, therefore, always necessary to make sure when a stain has been used that the wood has become thoroughly dry. It may be suggested that an ordinary flat iron is very useful for small patches or local chills.

Not less important is the employment of suitable materials both in the polish and in what, for want of a better word, may be called the tools of the polisher's art. These latter are of the simplest possible description, and consist almost entirely of wadding or cotton wool and soft linen or cotton rags from which the rubbers to apply the polish are made, and a few bottles, etc., to keep the various polishes, stains, and their ingredients in. The exigencies of space, however, require that consideration of these and other matters must be left to a future occasion.

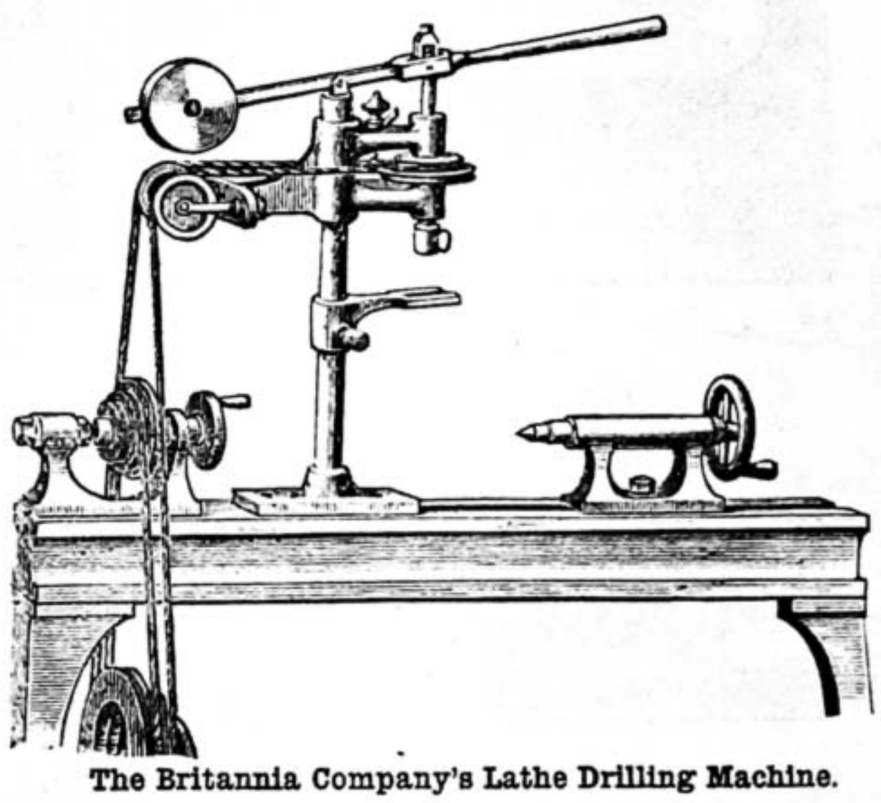
OUR GUIDE TO GOOD THINGS.

*** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

1.—The Britannia Company's Lathe Drilling Machine.

My attention has lately been drawn to the Britannia Company's Lathe Drilling Machine, and it seems to be such a handy appliance, and so desirable an acquisition for everyone who owns a lathe, that I think it well worth while to make special mention of it here. The Britannia Company supply several kinds of drills, well calculated for the performance of all kinds of work, heavy and light; but this, as far as I am aware, is the only one which they manufacture as a special adjunct to the lathe. Its construction, and the manner in which it is fixed on the lathe and driven by the lathe treadle, as well as the manner in which the drill is held and actuated, and the object to be drilled presented to the drill point, are all so clearly shown in the accompanying illustration, that there is really no occasion for me to describe them in detail. All that need be said now is that it can be used on any sized lathe, which is a desideratum, and driven either from below, if for a treadle lathe, or from an overhead pulley. The price of the machine for lathes up to 6 in. centre is £2 2s. Those who utilise the lathe as a motive power for fret sawing should buy this machine.

Doubtless many a reader of WORK, who possesses the Britannia Company's well compiled and effectively illustrated Catalogue of Engineers' Tools, Amateur Lathes, etc., supplied, the larger one at 1s., and the smaller one at 6d., will have felt some surprise when he has noted the large number of machines and appliances of various kinds that are manufactured and sold by the Company, many of them—especially the lathes, planing machines, and shaping machines—being of enormous size and power, and well-nigh of boundless capacity. And more than this, he must have thought, if he thought at all, that a Company which turned out such powerful and heavy engineers' tools and machines as these, so numerous and so constantly improved and improving that they are known, like convicts—I trust the Company will forgive the simile—by numbers and not by names, must be one of considerable importance, possessed of large, well-equipped workshops, endowed and backed with almost inexhaustible resources, and finding daily bread for a very large number of hands. My anticipations in these directions were in no way disappointed when I visited Colchester not long since for the purpose of looking over the Britannia Company's works, at the invitation of the courteous and energetic manager, Mr. T. M. Bear, who is at once the mainspring and motive power of the whole affair. Nothing but a personal inspection is sufficient to show the magnitude and extent of the work turned out in the Company's extensive and well-ordered factories, in which are to be seen immense workshops, densely, but not inconveniently, occupied with a variety of machines in motion—one, a screw-cutting machine, stretching over the whole width of the principal workshop—fashioning, shaping, planing, and cutting the different parts of the numerous machines on order with a rapidity and ease that would appear simply wonderful to anyone unaccustomed to their action. Indeed, one might say that some hundredweights of iron



The Britannia Company's Lathe Drilling Machine.

introduced at one end of the factory comes out a finished machine at the other. I regret that space fails me to speak more at length of the special machines manufactured there, and the handsome, well-lighted, and capacious drawing-rooms, pattern-rooms, and other necessary offices attached to the workshops. One thing, however, I am bound to mention; and that is the order which prevailed throughout the factory, and the attention every man paid to his work, apparently taking the utmost interest in what he was doing, and in looking to the machine that was working under his care. When scattered here and there among the machines, the hands in the employ of the Company did not appear to be very numerous; but this idea, as far as I was concerned, was soon wiped out when the dinner-hour came, and the bell gave the signal to cease work, and from 150 to 200 men soon gathered from all parts of the workshops, and poured out through the factory gates, without crowding and without undue noise, about three abreast, in a continuous stream, which kept going for some time before the factory was left to the manager and myself, and a dead silence followed, which offered a marked and marvellous contrast to the busy hum of active workers and moving machinery that had prevailed a few minutes before.

SHOP:

A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

On Learning Marbling.—F. P. (*Newport*) writes:—"Can you spare me space in which to reply to our friend's (R. A. D.) letter upon the above subject, appearing in page 175 of Vol. II.? My answer to W. H., therein alluded to, is condemned as 'bad advice' by one who, from the general tone of his, nevertheless useful, letter believes himself competent to write thereon. The pith of both W. H.'s query and answer in 'Shop' referred to the *cost* of learning. The *practical* value of all that has heretofore appeared in WORK upon any subject few will question, and the 'value for money' aspect of this wonderful weekly pennyworth needs no consideration. Time again will show how far the writer was justified in allocating to a future series of papers the premier position for '*small cost* and practical usefulness.' Respecting, however, the definite courses that were suggested to the learner, I would ask, Does not 'a clever marbler' imply a capable, experienced, and trained craftsman? If it does not, to the thinking of friend R. A. D., surely he is unfair (doubtless unintentionally) to the writer in inferring and construing the same to mean an *incompetent* worker—one who pretends to imitate that which he has never seen, much less studied; in short, any poor craftsman, down to the paper-stainer's boy, who marbles sixpenny sienna (?) at the rate of some 36 feet by 21 in. per minute! F. P. would give place to no reader of WORK in impressing the necessity of studying from Nature; but the 'matter-of-fact' side and technical aspect must not be overlooked. Is not the name of any great art-worker usually connected with his master? 'Nature' can scarcely be expected to teach an individual how to handle his brushes and tools, and what are the nature, properties, and values of his pigments and vehicles. Carry the inquiry still further, and let me give a definite instance:—I have a friend who is sufficiently an artist (unprofessional) in water-colours to have his work hung at the Academy. Surely we might say such an one can only now learn from Nature! My friend thinks otherwise, since he cheerfully pays a half-guinea to watch a professional master paint for an hour an imaginary landscape or a study of foliage. If there is sense in this action, surely a clever master is no danger to a would-be marbler; and I venture to assert, had R. A. D. been so fortunate as to be the pupil of a clever marbler like Mr. Moxon, Mr. Kershaw, or the late Tom Nichol, in more Northern latitudes, he would be a far better *practical* marbler than he is now—however able he may be. I am honestly obliged to my critic for reminding me of the *translation* of Van der Burg's work; and his information *re* the Technical School justifies his writing. I will only humbly endeavour to offer him some useful information in return. A prominent literary worker and marbler (from 'Nature') of forty years' experience gives an authoritative opinion of the above work, worth quoting as against the patronising laudation of R. A. D.:—'There is a Dutch work, price £2 10s., in which *some of the specimens are fairly good* (my italics), but the letterpress instructions are difficult to follow out, being a translation from the Dutch.' Now a few final queries for my critical friend. If this Dutch work is valuable and worth following, as he says, would not the *personal* instructions of either of the brothers—doubtless 'clever marblers'—be of more value? If there is only 'one class of its kind in the United Kingdom' for the would-be marbler to study at, and that in Kennington Park Road, what are all the poor provincials to do? Can they go into the streets and lanes to study rouge roi, jasper, and porphyry from 'Nature'? And if they could, would not there be *something* still to learn about the manipulation of tools, colours, and the varnishing, felting, and polishing? There are two other good collections also worth mentioning of natural specimens—the Geological Museum in Jermyn Street, London (Marbles), and the Royal Botanical Gardens at Kew (Woods), so that the 'City and Guilds, etc.,' very fine collection (all honour to it, however) is not quite alone in its magnificence. Let me here ask R. A. D., and all other earnest believers in work of any kind, to give the contributors of this paper a 'fair hearing,' or rather reading. Surely R. A. D. could count upon the publication of useful information without misconstruing and wrongly characterising so practical and common-sense an answer as, I believe, I have shown to be that which he condemns as 'bad advice.' If 'marbling' is ever to become as popular again, as a decorative feature in buildings, as it was thirty years ago, I venture to opine that it will not be due to the marble studies and paintings of L. Alma Tadema, and such other gentlemen who may spend time *ad lib.* copying pieces of marble upon paper, etc., at the 'Kennington Park Road' class (excellent imitations although they may be), but rather will it be due to those workers who can apply their imitative faculties in a *practical* manner, and offer, not solely minute and slavish imitations, but as much *natural effect* of colour and figure as the very primary and ever-present considerations of cost and comparative values will allow."

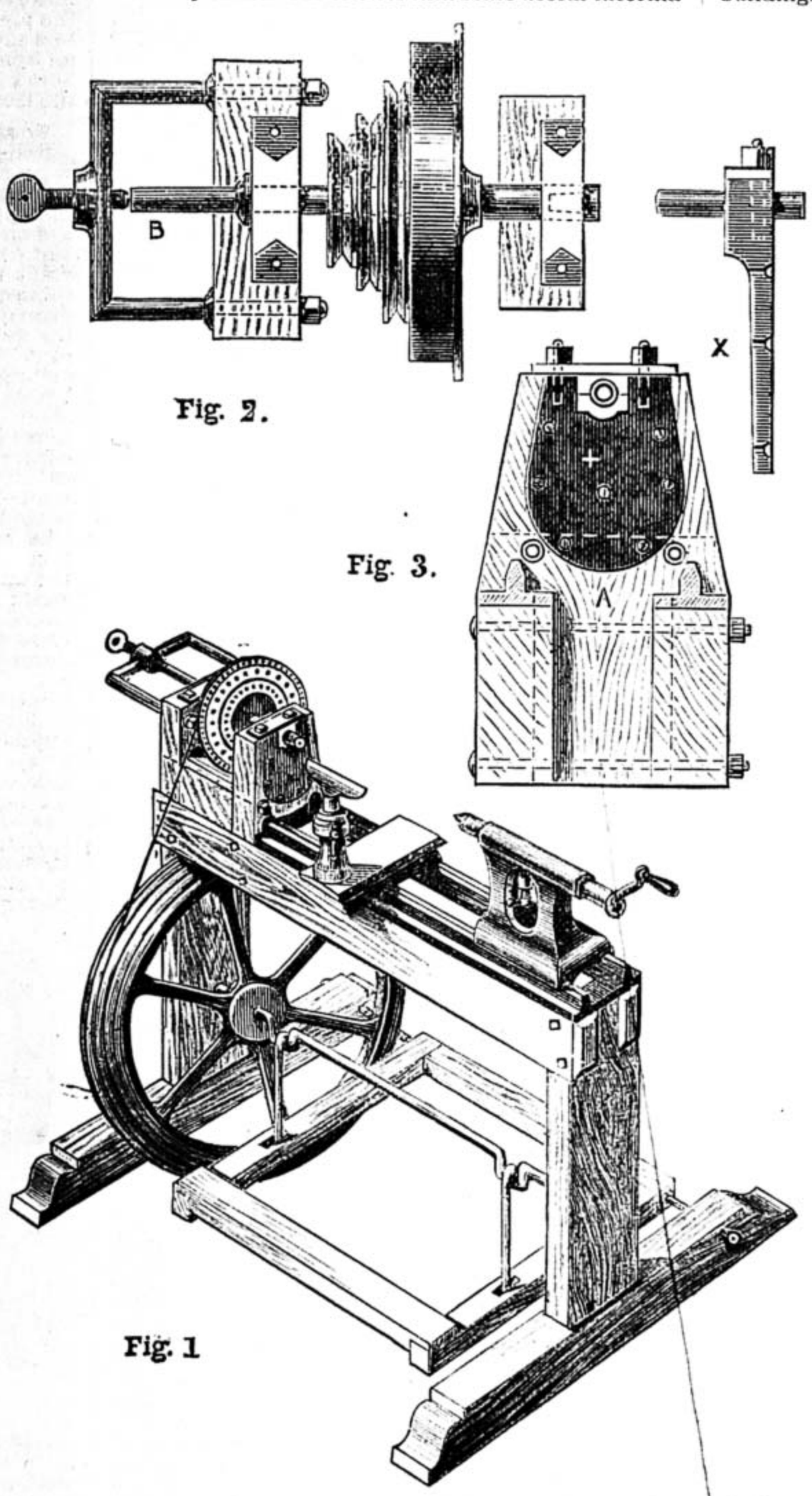


Fig. 2.

Fig. 3.

Fig. 1

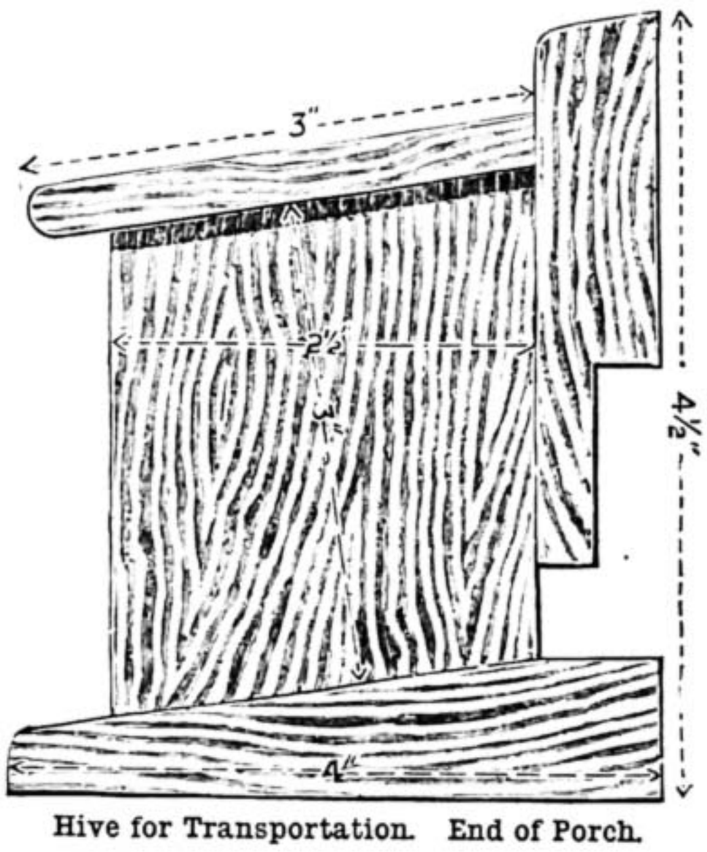
Home-Made Joiners' and Blacksmiths' Lathe. Fig. 1.—General View of Lathe. Fig. 2.—B, Plan of Heads; X, Section of Cast-Iron Plates. Fig. 3.—A, Elevation of Front Headstock with Section of Bed.

Home-Made Joiners' and Blacksmiths' Lathe.—PRACTICAL JOINER writes:—"Having been a subscriber to WORK since its commencement, I have noticed many inquiries regarding lathes, their construction, etc., especially home-made ones. I have copied one in our shop, made by my father, and which has been in use exactly sixty years. It is drawn in perspective—perhaps not very perfectly, I never having learnt that branch of drawing. I trust my fellow-workmen will be able to understand it. The maker was a joiner in a country village, with, I must confess, a talent for fitting. The lathe is 10 in.: centres partly wood, partly cast iron: the bed is of hardwood plank, 8 in. by 3 in., with a cast-iron top nicely planed, and fitted to the top of wooden bed. This makes an excellent job. The poppet slips beautifully along it. The fixed heads are also wood and iron, the end standard being carried up high enough to form the back bearing; the front ones checked in between the two planks, and a piece of dry wood fitted nicely in between the two, and bolted together, making the whole perfectly rigid and steady. The sliding head is of cast iron, and is the most difficult part to construct. This head was bored out with a flat boring bar, with a piece of half-round wood at the back; after each cut, a piece of thickish paper is put in between the wood, and on the bar, and so on. I bored a small engine cylinder with this same tool, and succeeded perfectly. The mandrel runs in brass bearings; these brasses are fitted into cast-iron plates, the front of which is seen on elevation at A, Fig. 3 (end view of iron bed is also seen here). A section of this plate is also seen in drawing marked X. B is a plan of heads showing the whole construction. The bearings are held down by a flat bar and two nuts. This plate is much thinner where it is fitted into the head than where it supports the bearings. These plates require careful fitting, being kept flush with the top of the wooden heads, and fixed with large screws. The mandrel is 15 in. long, 1½ in. thick at front bearing, ⅞ in. at back one, with collar as shown, and back centre to tighten up. The fly-wheel is 30 in. diameter, of cast iron, with a wooden rim fitted compactly and firmly round the iron; the grooves, four in number, are turned on the wooden rim, and being turned on its own axle, ensures perfect truth in running. The top pulley is about 10 in. diameter, smallest speed being 4 in. A brass dividing plate completes it. The main axle is 1¼ in. square, with two cranks. The bed of this lathe is 10 feet long, but the cast-iron part is only 6 feet, the remainder being carried out in wood, fitting well with the iron, as we seldom work so far back. The lathe is capable of very heavy work—such as wheel naves, or hubs, as they are called in England; these are from 8 in. to 12 in. diameter. We also turn all our wheels not exceeding 20 in. on it; it also carries a circular saw, 12 in. diameter, which is one of the most useful tools in a country shop. I have seen the hand or foot-power saw condemned in print. All that I can say is we would not lose ours on any account. The speed and accuracy with which 2 in. deal can be sawn, for instance, into such stuff, would rather astonish the eloquent advocate of the rip saw; it is not only the speed, but they are so accurately done that they can be dressed up with the plane in no time. I know what it is to dress up hand-saw work; as we say down here in Roxburghshire: 'it is nae better than it's caa'd.' Then for cutting tenons

it is first-rate; in order to dress a 12 in. saw lightly, it requires the band from a 24 in. speed to the 10 in. one. But I am afraid I am wandering, or maybe maundering away from my text. Any competent workman would have no difficulty in making such a machine; one man made it, and this in the year 1830, when there were no such tools as can be had now. The general idea was taken from a popular cyclopædia of that time, and, honestly speaking, it has not cost us over twenty shillings for repairs; and the parts which failed were of birchwood, these being the two cross feet and the top pulley. I shall be glad to answer any questions regarding this lathe, if anyone should try his hand."—[This is a capital lathe. It must have been a stunner sixty years ago. In these days, cast iron is so cheap and easily worked, I doubt whether it would be a saving to make such a lathe of wood now. If I am "the eloquent advocate of the rip saw," I should want to know, before modifying my opinion thereon, whether our Roxburghshire joiner can drive that 12 in. saw with his unassisted foot when ripping 2 in. deal for blind slats. He may, perhaps, at a speed ratio of only 10 to 24, which is very slow. Query: What is the most advantageous speed for a circular saw driven by *one man?* As, however, PRACTICAL JOINER turns up naves of 8 in. to 12 in. diameter, I rather think he must be in the habit of calling upon one or two others to help him tread; or, does he use the engine the cylinder of which he bored? A 6 in. or 8 in. saw is very hard to drive when cutting 2 in. wood at ordinary speed: do we make a mistake in running our saws so fast?—F. A. M.]

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Hive for Transportation.—BAR FRAME, J. J., AND OTHERS.—BAR FRAME asks for a description of a hive which would be suitable for moving to the heather by rail or boat; and, as I have such a hive in my possession, a short account of it will probably be acceptable to others as well as to BAR FRAME. It is a twin hive, capable of accommodating a couple of strong stocks, but, if it is thought too heavy in this form, it might easily be made half the length, when it would do for a single hive, and be more easily carried about. Twin hives, however, possess the advantages of economising heat, and being almost as easily made as single ones while doing the work of two. To make this hive, I first construct a box of inch stuff, 17 in. by 34 in. internal measurements. It is 9 in. high, and the bottom is nailed on, plenty of good glue being applied to every joint. Before the bottom is nailed on, I cut a doorway ⅜ in. high and 8 in. long out of each end. I also strengthen



Hive for Transportation. End of Porch.

the bottom with three or four cleats nailed across. It is to be understood that the bottom is planed flush with the sides all round. I next prepare the inner sides, which are to support the ends of the frames, and give the hive double walls. These are two in number, 34 in. long, ⅜ in. thick, and 8½ in. high. They are bevelled on top, leaving about ¼ of an inch to support the frames, or a strip of tin might be tacked on for the same purpose, in which case the inner sides would be 8¼ in. high, the tin bringing them to 8½ in. These sides are next nailed in place, leaving a space between them of 1¼ in.; nails should also be driven up through the bottom into these sides, to give additional strength to the structure. The ⅜ in. space between the inner and outer sides may now be filled with cork-dust, chaff, or some other non-conductor of heat, and a small strip of wood nailed on top to keep it down. So much for the body of the hive, which will require a well-fitting dummy to keep the stocks apart. The roof I make on the Cowan principle, sloping from 4½ in. to 9 in. in height; in the breadth of the hive, the top is covered with ½ in. boards, placed edge to edge, covered with calico and painted. If three crates of sections are used, a riser 8¼ in. high and the size of the body-box will be required. Plinths break the joints between body-box, or riser and roof. The hive is now complete, except for the alighting board and porch, which I make in one. As it is rather more difficult to describe than the body part of the hive, I give an end view of it (see sketch). I first cut pieces, which I may call the ends, to about the dimensions given in the figure, but this can be varied much. I then nail the top and back in place, having previously rebated the place for the doors in the latter; the alighting board comes last, and projects back far enough to support the runners. The length is about a foot, and the entire porch is secured to the hive with a couple of screws. It can thus be removed when a journey is in contemplation, and replaced with the greatest rapidity. I have now fulfilled BAR FRAME'S requirements in describing a hive handy to carry about, if the eaves are not made too wide; strong, and with few parts; and able to keep out the cold and rain at the heather. If it is made half the length, it would be still more handy, but heat would not be so much economised. I hope observatory hives will be treated of in due time.—APIS.

Plant Case for Window.—DEW.—To give full details for making a case such as you require would

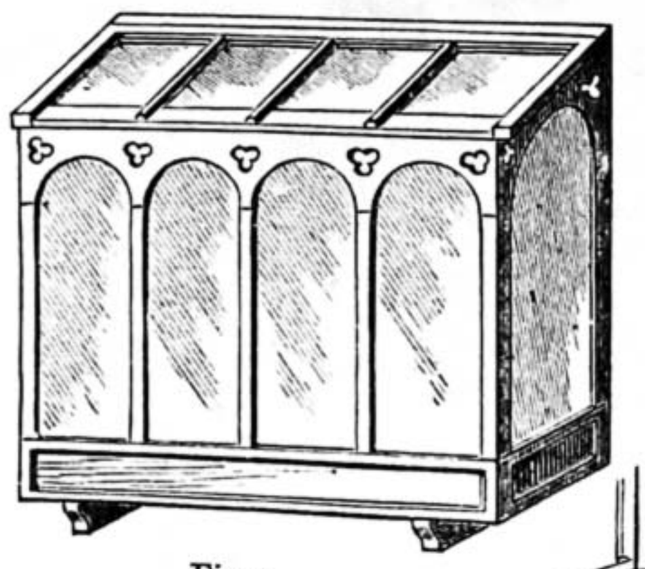


Fig. 1.

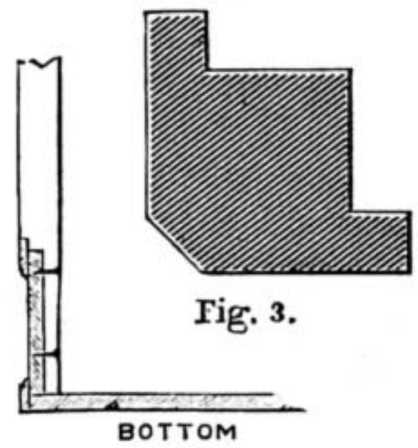


Fig. 3.

Fig. 2.

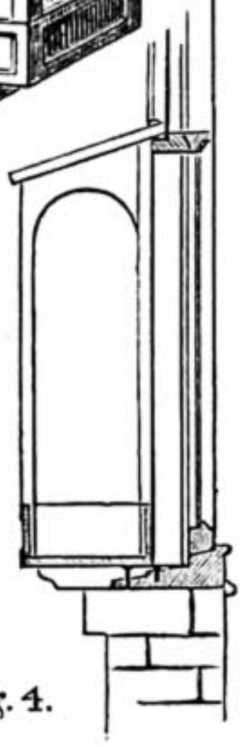


Fig. 4.

Plant Case for Window. Fig. 1.—Side and End Elevation of Case. Fig. 2.—Section of Box, showing Fitting of Corner Post. Fig. 3.—Section of Corner Post. Fig. 4.—Section of Case and Window.

take up too much of the space available for "Shop" replies, but the following brief description may, with the aid of the sketches, furnish you with sufficient particulars for your purpose. Fig. 1 shows the appearance of the finished case, the lower part of which consists of a box made to fit the width of the window in which it is to be placed. This box is made of ½ in. wood, and is about 6 in. deep, the bottom being firmly screwed to the sides and ends. Slips of ½ in. wood, 1½ in. wide, and having a small moulding or a plain chamfer worked on one edge, are then planted on to the outside of the box, so as to form panels on the front and ends, the piece on the top edge projecting ½ in. above the box to form a rabbet for the glass. The corner posts are then fitted in their place by cutting them away as shown in Fig. 2, and fixing them by means of screws. These posts are of the section shown at Fig. 3, and can be chamfered on the edges. Fig. 4 shows a section through the case and window when in position, two brackets being fitted to the window-sill and firmly screwed down to it, upon which the case rests, being also secured at the top by means of two iron straps screwed on the woodwork of the case and window. The roof of the case should come just above the bottom of the top sash, so as to allow of its being pulled down if required. A piece of wood of the same thickness as the roof is fitted close to the window-glass, and the roof is hinged to it, and can then be opened at the front. The semi-circular tops of the front and end openings are cut out of a piece of ¼ in. wood, which is let in flush with the corner posts and bars, trefoils being cut out to lighten the appearance; the glass goes right up behind this wood, and covers the trefoil holes; or a very good effect can be obtained by cutting away the plain glass behind the holes and putting in blue or red glass; if your case is seen from the road, this is worth doing. Of course, a zinc lining is required to prevent the damp injuring the woodwork, and a pipe should go through one corner of the bottom to let away any surplus water. Use yellow deal if possible, and prime thoroughly with two coats of thin white lead before painting. I think these few hints will give you an idea how to proceed, but if you find any difficulty in the course of the work, write again.—G. LE B.

Glazing Cuffs and Collars.—LAUNDRY.—There are various ways of doing this. Putting a little gum arabic into the starch is considered to give a nice glaze. Another way is with wax—into a pint and a half of boiling water in a saucepan put an ounce of wax; melt over the fire. When it has stood a few minutes to cool, stir into it half a pound of starch, previously mixed with a little cold water; the whole to be boiled and stirred for half an hour. The wax starch thus prepared is to be used cold. We believe, however, that the glazing substance most used at the present day is borax. Some borax is dissolved in a saucer, the linen is starched in the usual way, an iron is passed over it, a clean rag is dipped in the borax and rubbed over the face of the article, and the ironing then finished.—S. W.

Boot Soling and Welting.—S. T. (*No Address*).—Round the sole a little wider than the last: any way, at the heel or outside joint. The breadth of the feather is decided according to the substance of the upper; but for medium work it must be about ⅛ of an inch; and to make this feather, a strip of the leather must be taken away, and the lighter you want the sole to look when finished, the more of this you take away at A (Fig. 1). A line should be drawn round about ⅛ of an inch from the edge, and the awl put in here in holing, as B, and brought out at C. This is all done on a board, not on the last, as an insole is fitted. For Question 1 you say a "turned pump." All pumps are turned, but all turned shoes are not pumps, and as you ask in Question 4 if you should start sewing at "the left-hand corner of the heel," I conclude you mean what are called "sew-rounds"—that is, it is sewn all round while it is inside out, whereas the heel of a pump is made after the shoe is turned to its right side out. The sole should be tacked to the last with four tacks (the sole being grain side to the last), and then the upper lasted on with tacks, as you would for a welt: only use small tacks, and the tops must be lasted inside out. The sole should be fitted for this class of work to such a nicety (that is, have a very clean-cut edge), that after it is turned and second lasted it should need only to be coloured and ironed. The stitches for a gent's should have about five to the inch, and you should commence stitching at the corner of the heel, sew up one side of the waist, round the foreport, down the other side of the waist, and then round the heel. The feather for a broad welt can scarcely be too narrow—in fact, it must be sewn full, or its beauty is spoilt; and after the welt is sewn in, it should be beaten up, not between "two hammers," but with a welt-beater in the left hand and the hammer in the right. A welt-beater is generally made from

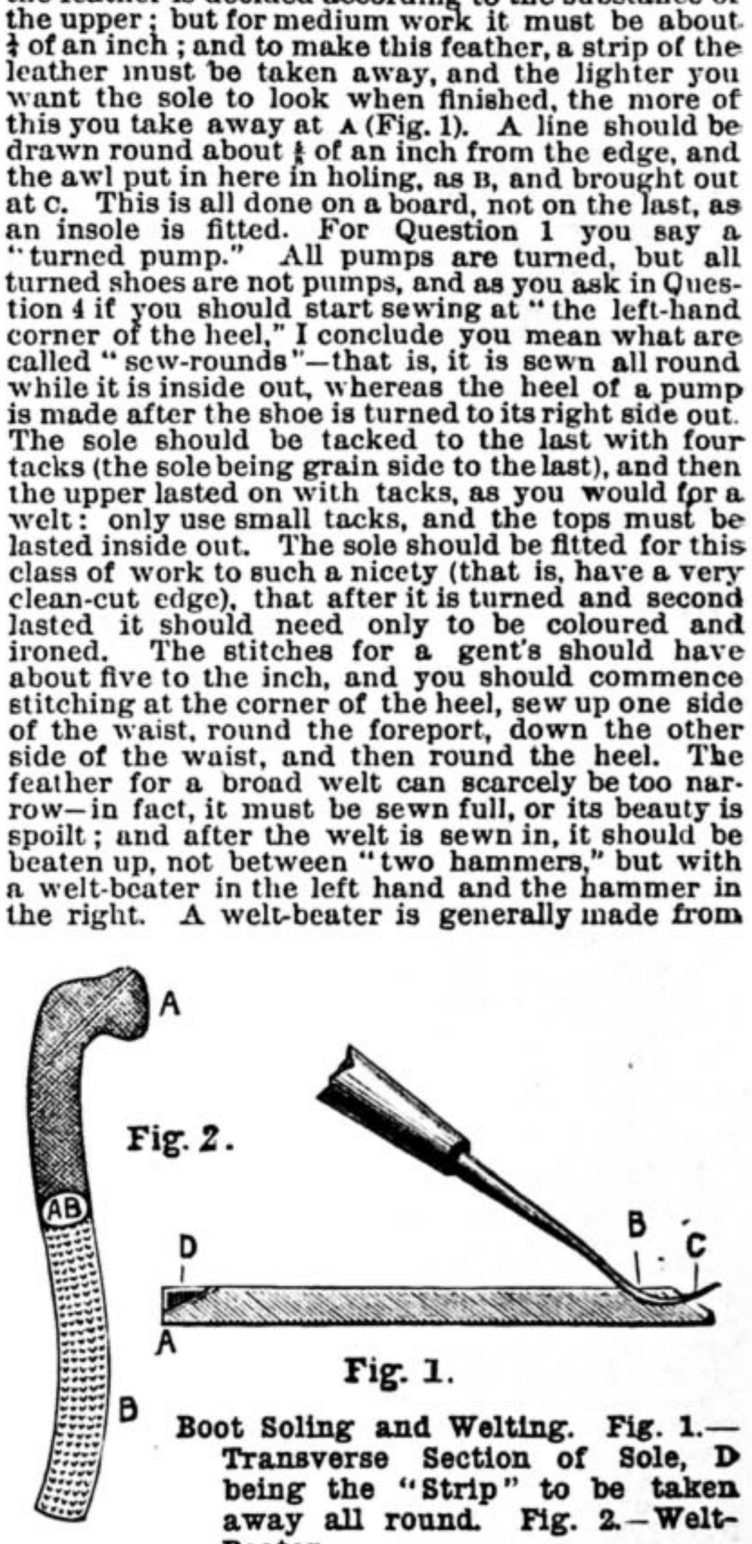


Fig. 2. Fig. 1.

Boot Soling and Welting. Fig. 1.—Transverse Section of Sole, D being the "Strip" to be taken away all round. Fig. 2.—Welt-Beater.

an old rasp, beaten out while hot, and turned over, as in Fig. 2, and A is put between the upper and welt, and B forms the handle.—W. G.

Shading Marquetry.—J. K. (*No Address*).—Such shading as you refer to may be done with hot sand, heaped up in the centre of the veneer you wish to shade, if it is large enough. All such work requires "dodging." It cannot be done mechanically. It may also be managed by heating a piece of iron till it is hot enough to brown the wood when held near it. Use either the end of the poker or a piece of wire, according to the size of the work. I cannot say how your old specimens are done without seeing them, and very likely I should not be able to tell even then, as no doubt old workers had their own methods of doing out-of-the-way jobs like this one, just as they do now. When an operation is a common one, one or more recognised methods are generally practised, because they have been found the best for obtaining a desired result; but in exceptional cases the worker must be guided by his experience. This will sufficiently guide you, whether you are merely asking from curiosity or because you wish to imitate the work. In this latter case you may be glad to know that the shading may be done with ordinary water-colour paint on the surface, after the veneer has been laid and cleaned up.—D. D.

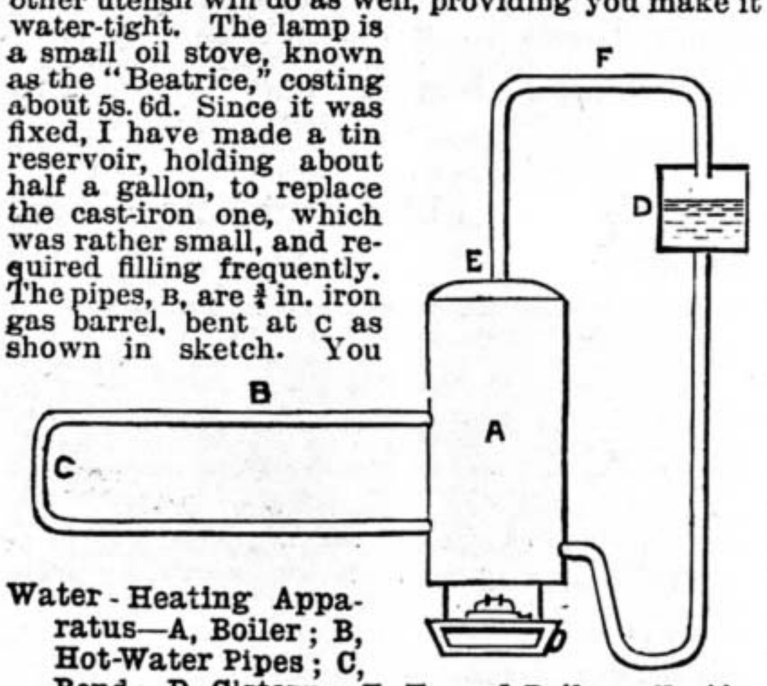
Fretwork.—F. G. (*London, N.*).—No elementary articles on this subject have appeared yet, but some are in course of preparation.—D. A.

Hand Camera.—E. T. (*Bruntcliffe*).—They vary a little in detail, but both are useful instruments. Abrahams, in Aldersgate Street, has a very simple and workable one—the movement of one lever changing the plate and fixing another ready for exposure.—D.

Painting Inside of Aquarium.—JACK OF ALL TRADES.—Try Aspinall's enamel; choose the colour you think will best suit the aquarium and put on three coats, allowing each sufficient time to dry, and do not put in the fish until you have had it filled with water for, say, a fortnight, changing the water every two days during that time. A friend of mine has recently treated an aquarium similar to yours in this manner; it has now been in use about six months and is perfectly watertight, while no apparent harm has been done to the fish.—G. LE B.

Austin-Leclanché Battery. — J. A. (*No Address*).—The ingredients and all other accessories required for making and fitting up the Austin-Leclanché Battery can be obtained from Whitney's, the Science Depôt, City Road, London; also of Caplatzi, 3, Chenies Street, Tottenham Court Road, W.C. Either of these will favour you with their price lists for inspection by enclosing postage. The price of Mr. Caplatzi's list is 2d.—H. E. A.

Water-Heating Apparatus.—A. H. H. (*Birmingham*).—You do not state the size of the building you propose to heat, but I imagine from your query that it is a small fernery or window conservatory. A friend of mine fitted one with hot-water pipes as shown in sketch, and he is perfectly satisfied with it. I will describe it as he made it, but you need not follow it in all details, as he had the saucepan and lamp by him, and you may have something else that will do as well. The boiler, A, consisted of a two-gallon tin saucepan with the handle removed and the lid soldered down. Any other utensil will do as well, providing you make it water-tight. The lamp is a small oil stove, known as the "Beatrice," costing about 5s. 6d. Since it was fixed, I have made a tin reservoir, holding about half a gallon, to replace the cast-iron one, which was rather small, and required filling frequently. The pipes, B, are ¾ in. iron gas barrel, bent at C as shown in sketch. You



Water-Heating Apparatus—A, Boiler; B, Hot-Water Pipes; C, Bend; D, Cistern; E, Top of Boiler; F, Air-Pipe.

can, if you choose, use two bends, or two elbows joined with a nipple to form the bend, but you will find it cheapest and best to have it bent. The boiler must be placed either below or on a level with the pipes, as shown in sketch. You can run the pipes to suit your convenience, providing you take the pipe from near the top of the boiler, and return it to the bottom, as shown. If you run the pipes above the level of the boiler, it will be best to take the pipe from the top of the boiler, E, and run the air-pipe, F, from the highest point in the flow-pipe. You ask for dimensions of tank, but in a low pressure apparatus no tank is required, except for convenience of filling, as there is scarcely any loss of water. My friend used a cake tin for the cistern, and ran ½ in. composition gas-pipe to supply the boiler. The air-pipe is ¾ in. composition, and this must be carried above the level of the cistern. It need not be carried over the cistern if not convenient. The hot-water pipes are tinned at the ends and soldered into the boiler, but if you do not mind a little extra expense, it will be best to solder unions into the boiler, and connect the pipes to them. If you do this you will have no difficulty in making your connections, and will be able to disconnect and re connect boiler easily at any time. If you find any difficulty, I shall be glad to assist you if you write again.—T. W.

Bicycle.—CYCLOS.—Complete sets for making diamond frame safety, consisting of tubes, stampings, hubs, ribs, tires, chain, forks, brackets, saddle, pedals, spring, and every item to complete the machine, can be bought of the St. George's Cycle Company, Upper Street, Islington, London, for the sum of 90s. I cannot say what parts are finished, but should say the hubs and bottom bracket are. Of course, the rims, tires, chain, saddle, etc., are finished. If CYCLOS will write to above address, they will give him a catalogue and list wherein the prices of all rough and finished parts are given. If CYCLOS is not much of a mechanic, he should get as many of the parts machined for him as possible. After that he may have difficulties, but no special ones, providing he reads up a treatise on the subject.—A. S. P.

Clock Cleaning and Repairing —P. H. B. (*Highfield*).—You did not enclose the letter you wished forwarded to PRACTICAL HAND.

Speculum Grinding for a Newtonian Telescope.—W. B. (*Bruntcliffe*).—I presume that you are acquainted with the principle of the instrument; if you are not, look it up in any elementary handbook on optics. Here is a rough diagram showing the arrangement of the mirrors and lenses. You will see that the light which falls on the large mirror, A, is reflected in a cone, which, before it reaches a focus, is intercepted by the small mirror, and turned aside through the eye-tube, D, to the eye-lens, E. The large mirror, A, called the *speculum*, and the small mirror, B, called the *flat*, will have to be ground and polished. If the speculum is to be, say, 6 in. in diameter (which is a good size to begin with, though you may make one larger or smaller if you wish), then the *flat* will be an oval about 1½ in. in the major, and 1 in. in the minor diameter. For the present, in order that you may set at once to work, let the *flat* drop out of the question, we will confine our attention to the speculum. You will want no tools, properly so-called, at all. What has to be done is this. *Given a flat disc of plate-glass, free from flaw or defect, to dig out one surface of it to a certain parabolic curve.* And if we are to set about getting this parabolic curve in an intelligent manner, and with a prospect of success, we must first make it a sphere. So, for the moment, forget the necessity for the parabola, and state the problem more simply, thus:—*Given a flat disc of plate-glass, free from flaw or defect, to dig out in one surface of it an exact spherical concavity.* The concavity must be such that its section will be an arc of the circumference of a circle, the radius of which will be twice the focal length of the desired telescope. The focal length of a concave mirror is, roughly speaking, the distance from the centre of the reflecting surface to the point where the lines of the reflected rays intersect, or, in other words, to the apex of the cone of reflected light. Thus, with a speculum 6 in. in diameter, for which a good focal length would be 5 ft., the curve of a diametrical section of the mirror must be part of the circumference of a circle 10 ft. in radius or 20 ft. in diameter. You must really master this, because, until you have mastered it, you cannot intelligently proceed. A gauge by means of which you will be able to tell when enough glass has been ground away can be easily made as follows:—Procure a lathe 10 ft. 6 in. long. Through it, close to one end, stick a long bradawl for a pivot, by which one end of it can be fastened to the floor, while part

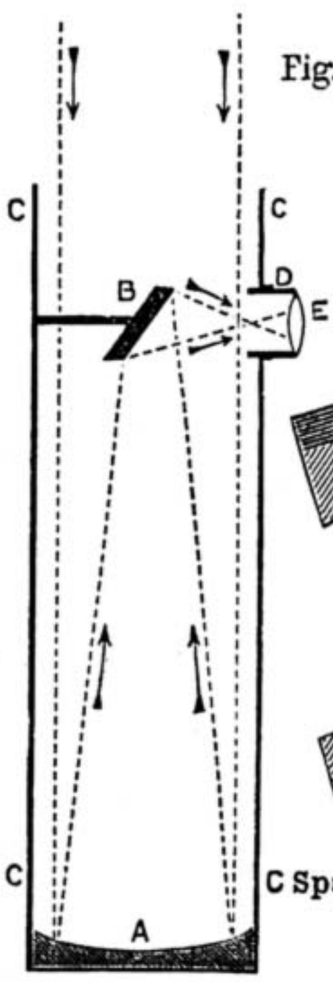


Fig. 1.

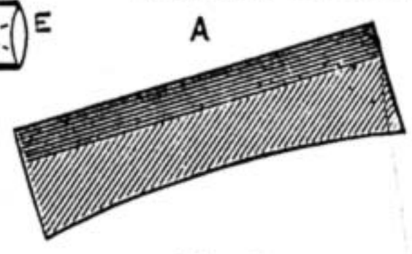


Fig. 2.

C Speculum Grinding for a Newtonian Telescope.—Fig. 1.—A, The Speculum; B, A Small Flat Mirror; C, C, C, C, Telescope Tube; D, Eye Tube; E, Eye Lens. The dotted lines indicate the manner in which the Light from the Object is reflected from the Speculum to the Eye. Fig. 2.—A, Concave Gauge; B, Convex Gauge. In each case the curve is much exaggerated.

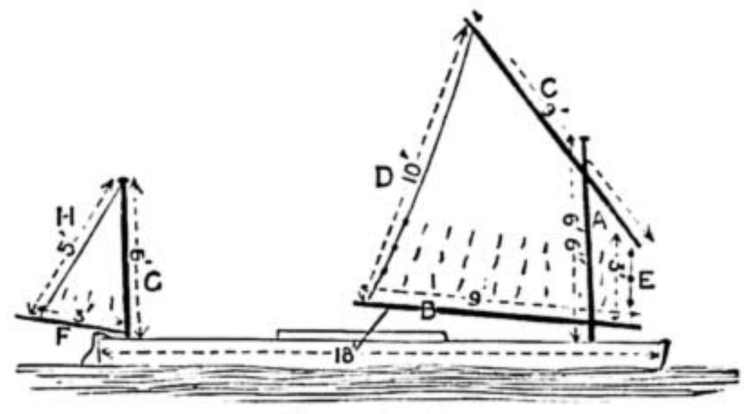
of a circle is described with the other end. In this other end, 10 ft. distant from the bradawl, fix a pointed steel tool. Underneath it, on the floor, place a 7 in. square of stout soft sheet zinc. Then, the bradawl being fixed firmly, the steel point may be made to mark the desired curve on the zinc, which must be cut with great care through the marked line, the curved edge being afterwards neatly worked together with a little wetted emery powder until they fit precisely. The straight-edge of the zinc can then be bent over (as in Fig. 2) and tapped down to keep the gauge rigid. The convex gauge, A, will fit the concave of the speculum exactly, the other gauge, B, we shall want to use otherwise by-and-by. Now for the glass. Get discs of plate glass 1 in., or better, 1¼ in. thick and 6 in. in diameter. You will be able to get them from any large plate-glass merchant, and they will cost a few shillings. The plate-glass people will cut them to a circle, but will leave the edges jagged. These edges must be smoothed down, either on a coarse grindstone, using plenty of water, or by mounting the two pieces of glass in a lathe and properly edging them. How to do this, I will tell you in another note.—E. A. F.

Extracting Gold from Gilt Buttons.—NO NAME.—From a jeweller's point of view, it is not worth the trouble and expense, there being so little gold put on. Even refiners do not particularly care to buy them at the low rate of 1s. per lb. I would go into the method of stripping by acid, but there are better methods I fancy in which a gilding battery is employed. Ask G. E. B. of WORK staff.—H. S. G.

Pump Delivery, Pressure on Fittings, Contents of Tanks.—TALBOT.—To find the quantity of water delivered in gallons per minute by a pump with a 4 in. barrel, multiply the length of stroke in feet by the number of *effective strokes* per minute, and by 0·5454. For a 5 in. barrel, replace the multiplier 0·5454 by 0·8522. This applies to any kind of pump. If the pump is double acting, all the strokes will be effective, but if single acting, only half of them. To find the pressure per square inch upon any fittings, measure the maximum height in feet of the water level above the fitting and multiply it by 0·434. The *size* of the supply tank does not affect the question. To find the quantity of water in an oblong or square cistern in gallons, multiply together the length, breadth, and depth, all in feet, and multiply the product by 6·25. To find the contents in gallons of a round tank, multiply the square of its diameter in feet by its depth in feet, and the product by 4·9.—F. C.

Pantograph.—J. B. (*Southwark*).—As a pantograph can be bought for sixpence, it is not worth your while to make one, for the materials would probably cost you more. You will find some remarks on the subject in "Shop," on page 669, No. 42, of WORK, which may be of assistance to you.—D. D.

Canoe Sails.—T. P. (*Islington*).—I submit rough sketch of sail plan that would suit canoe of dimensions given. The best article on canoe sails, etc., is in "Canoe and Boat Building," by Stephens, pub-



Canoe Sails.

lished by *Forest and Stream* Publishing Company of New York. A licence on the river Thames for a canoe from January 1st to December 31st is £2.—L. Y.

Mother-of-Pearl for Inlaying—W. B. (*London, E.C.*).—The mother-of-pearl can be obtained from Mr. Henry Chatwin, 30 and 31, Darwin Street, Birmingham. He will also supply you with prepared shell of any thickness for saw-piercing, and will also cut it into shape if you like. The prices will be willingly given on application if details of thickness and quantity required are sent. The tools to work it that you will require are saws and files, all descriptions of which, including the polishing materials, can be obtained of Messrs. Cotton and Johnson, 14, Gerrard Street, Soho, London, W. Here is some idea of the cost: Saw-blades, from 3d. per dozen; piercing-saw frame, from 3s. upwards; file, about 6d., although you can get small ones down to 1½d. each. With these you should be able to get the shell into shape—that is, if you have it already slit to your desired thickness. If you wish to work from the shell direct, which I do not advise, you must go in for a hack-saw as well. With any or all of these tools use water or soapy water. To polish it, when you have done filing it, you must first get rid of the file marks with a piece of pumice-stone, ground flat, and water; then follow on with finely powdered pumice-stone and water, or oil, or better still with sulphuric acid and water. Vinegar will do if the acid is not to hand. The powdered pumice can be applied by means of a cloth lap (see a previous answer on polishing opals, etc.), or a leather buff, to be bought for a few pence at Gerrard Street; or even a piece of rag wrapped round a piece of wood. With this you must obtain quite a regular and smooth, but dull, surface. The next step is with similar tools, *not* the same, but to use powdered rotten-stone with any of the before-mentioned fluids. The final polish is best given with the palm of the hand, on which powdered rotten-stone is rubbed. Fine whiting may also be useful in place of rotten-stone. I think I will close this reply by mentioning a suitable pin or peg to aid you in piercing. You can get one at Gerrard Street. It is a piece of wood some 8 in. wide and 5 in. long, tapering from ¾ in. to ¼ in., and with a piece cut out like sketch. It is attached to a board or table by two screws, and projects some 4 in. from it. With this you should be able to work the thin shell without accident, for you can obtain support in any direction. One last word. Get your shell already polished if you can. The appliances and practice they have give a much better result than you will be able to get. I almost forgot to say that a grindstone will almost be necessary if you work the whole shell yourself. —H. S. G.

Metals —AMATEUR.—You can get quantities of corrosive sublimate of Townson and Mercer,

Bishopsgate Street Within, or of J. Orme & Co., 65, Barbican, E.C. To make a saturated solution, dissolve ½ oz. of the corrosive sublimate in about 2 oz. of hot water. As it cools, the excess of salt will settle to the bottom, the remaining solution being saturated, and can be poured off to use, as mentioned in "Means, Modes, and Methods," page 714, Vol. II. Remember that corrosive sublimate is chloride of mercury, and very poisonous; the white of egg is the best antidote.—F. B. C.

III.—Questions Submitted to Correspondents.

Briar-Pipe Screws.—C. W. B. (*Plymouth*) will be glad to be informed where to obtain bone screws for pipe-mounting, ⅛ in. up to ¾ in. diameter.

Papier-Mâché Doors.—H. H. (*Cambridge*) writes:—"I have lately heard that doors of *papier-mâché* have begun to be made in Hamburg. Can any reader inform me whether or not this is the case, and where particulars relating to them can be obtained? It seems to me that such doors would be much less inflammable than doors made of wood, and could without much difficulty be made almost fireproof."

Carved Wood Bellows.—Caro writes:—"Can anyone tell me of a wholesale or retail address where I could get some bellows that I have carved nicely made up with brass nozzles and leather at a reasonable price; also where I can obtain similar bellows all ready for carving?"

Ivory-Carving Tools.—J. E. W. (*Camberwell*) writes:—"Will any reader please inform me where to get the above tools; also the lathe cutters used by carvers and stick-makers?"

Turned Wood Cases.—W. H. (*Stirling*) writes:—"I am in want of some cheap turned wood cases for packing a small phial in—size of case outside about 3½ in. long by 1¼ in. diameter. Can any reader oblige me with address of a maker?"

Slate Pencil Preparation.—R. M. (*Braintree*) writes:—"Seeing a recipe given in Work, No. 102, for a blackboard preparation, I am led to ask for a preparation to be applied to wood or millboard, which could be written on with *slate pencil*. Something of the kind is sold, called carbon slate."

Mice Cage.—Mart writes:—"Will anyone give me an ornamental design, with dimensions, for a white mice cage?"

Lace Frame.—Mart writes:—"Will anyone give me a design and dimensions for a macrame lace frame?"

Paper Machine.—Fourdrinier writes:—"Would any reader acquainted with the working of a Fourdrinier paper machine explain how the paper is transferred from the wire to the wet felt?"

Castings.—R. M. (*No Address*) writes:—"Will any reader give me some good information as to the best way of making my own castings? I want to make from 1 to 2 cwt. per day. Can I make them so as to be cheaper than 7s. per cwt., and what will be the probable cost of same?"

Square Turning.—F. W. (*No Address*) writes:—"Can any reader give me information of this kind of work? About what size wheels are used? How are the balusters, etc., fixed; and will the same wheels do for all kinds of work, or are the small articles, such as spindles, done in a different way? Do the turners use a gauge to get the mouldings to correspond on all the four sides?"

Enlarging Drawings.—J. W. (*Edinburgh*) writes:—"Would any reader kindly show the correct method of raising a drawing from half to full size: or the reverse, from full to half size? Say the scroll figured (page 760, Vol. II.), enclosed in a square (in rough numbers) 6 in. × 4 in. = 24 square in. If I take a half more each way, say, 9 in. × 6 in. = 54 square in., there is an excess of 6 square in. What is the rule?"

Bright Steel and Cloth.—Steel writes:—"What is the best solution to stick bright steel and cloth together exposed to damp?"

Battery.—Electric writes:—"Would any reader oblige me with full particulars regarding the construction of a dry battery?"

IV.—Questions Answered by Correspondents.

Electric Light.—W. G. (*Erith*) writes, in reply to J. S. H. (*Dublin*) (see page 782, Vol. II.):—"If you have an ordinary bell-push, use a clip to keep the knob pressed down while you require the light. A cheap plug switch would be better, and may be obtained for sixpence; the necessary current may be supplied from two 3 pint agglomerate Leclanché batteries; these can be used exactly the same as in electric bell work, and will light up a 3-volt lamp for several years if only used for, say, five minutes per diem, and the current does not fall off as in the old form of Leclanches. Of course, as many lamps as required can be used from the two cells, but only one at a time."

Schooner Rigging.—Teak writes, in reply to T. C. (*Manchester*) (see page 782, Vol. II.):—"If T. C. wants a good book on Rigging, etc., let him write to the *Bazaar* Office, 170, Strand, London, W.C., for 'Model Yachts,' by J. Du V. Grosvenor, price 5s 4d. by post."

Cart Materials.—W. P. (*Withington*) writes, in reply to W. S. (*Preston*) (see page 717, Vol. II.):—"I see that you are inquiring for addresses for procuring material and coach ironmongery for making a Battle-den cart. By writing to Mr. Wm. Cary, Red Bank, and Tomkinson & Co., Oxford Street, both of Manchester, you will be able to procure all that you require."

Photography.—C. M. V. (*Forest Gate, E.*) writes, in reply to C. E. H. (*Horwich*) (see page 734, Vol. II.):—"The method inquired for is termed 'Transparleum.' The company who introduced the process was the Continental Novelty Co., Leicester Square, London."

Joiners' Bits.—M. (*Bishop Auckland*) writes, in reply to A. A. W. (*Leicester*) (see page 734, Vol. II.):—"The bits used by joiners are shell-bits, centre-bits, American twist-bits, and expanding-bits. Shell-bits are semicircular, with the end turned up to form a cutting edge; they are slower in action, but not so liable to split the wood. Centre-bits have a centre point and two cutting edges, one cutting the side and the other the bottom of the hole. American twist-bits are formed like a screw, with two cutting edges, and a taper screw point; they are very quiet in action. Expanding-bits have a taper screw point, and a movable cutter for various sized holes."

Cardboard Models.—C. P. W. (*London, E.*) writes, in reply to J. F. (*Mullingar*) (see page 634, Vol. II.):—"So far as I can learn, there are no very exhaustive works on the subject. The only one I know of forms one of Weale's series published by Messrs. Virtue & Co., Amen Corner, Paternoster Row, E.C., and is entitled 'Practical Instructions in the Art of Modelling in Architecture,' by T. A. Richardson, price 1s. 6d. It is a very useful little treatise, but only professes to be elementary."

Transparleum.—Dean Forest writes, in reply to C. E. H. (*Horwich*) (see page 734, Vol. II.):—"In answer to your query, the name of the process of painting photos on glass which you could not recollect, is, I believe, 'Transparleum.'"

Frosting.—W. P. (*Withington*) writes, in reply to Beta (see page 734, Vol. II.):—"First clean the inside of the window, and polish it dry; then get some white lead, ground in boiled oil, and a little driers, and paint the window, twirling the brush round to imitate frosted glass. Do not paint too thickly, or you will obscure the light; leave for a few days to thoroughly harden; get the rule, and measure an inch next to the sash, and mark all round; get a straight staff and a blunt bodkin, and run it up on the paint by the side of the staff, thus marking the window all round; this, when well done, gives a nice finish. Stars and diamonds can be done in this way, drawing them first with a blacklead upon the paint; they should, however, be done with a geometrical preciseness, and I assure you the effect both from the inside as well as outside is very pretty. If left plain, it should, however, have a fine border, as already shown, an inch from the sash all round, to take away the plainness of the thing."

Electric Light.—H. E. (*London, N.W.*) writes, in reply to J. H. S. (*Dublin*) (see page 782, Vol. II.):—"From twelve to twenty large size Leclanché cells (according to resistance of lamp) will light a small incandescent lamp for from five to ten minutes at a time during a period of from twelve months to two years, according to use. An ordinary electric bell-push, or pressel, can be used, or a two-way switch, as most convenient. This is the least troublesome method."

Hardened Putty.—H. E. (*London, N.W.*) replies to J. G. (*Hull*) (see page 782, Vol. II.):—"If only a small quantity is wanted to be kept, put it into a vessel and cover with water. If a tub, pour a thin layer of linseed-oil over. If you wish to soften some hardened putty, knock it up with some linseed-oil with a mallet."

Hand-Power Circular Saw.—A. R. (*Scorrier*) writes, in reply to S. P. (*Penarth*) (see page 782, Vol. II.):—"If S. P. has plenty of money to dispense with, let him give it to the poor rather than lay it out in a machine that would be worse than useless to him for the work he wishes to do. If S. P. has no back numbers of Work, I would advise him to get at least all the numbers of Vol. II., in which he will find both sketches and information how to drive small circular saw benches for cutting shallow stuff. But he must not expect to cut 5 in. deep, unless he has other than hand-power. To drive a circular saw by hand is not work for a man, even in shallow stuff."

Lacquer for Brass.—W. P. (*Withington*) writes, in reply to Patience (see page 734, Vol. II.):—"Take 2 oz. of shellac, and dissolve in one pint of alcohol, coloured with turmeric; this turns the lacquer yellow. Clean the brass, and polish well off; then place it in a warm oven or before the fire, and apply this lacquer with a camel-hair brush. Keep the article in a warm place until the lacquer is quite dry, or it will be dull and lustreless."

V.—Brief Acknowledgments.

Questions have been received from the following correspondents, and answers only await space in Shop, upon which there is great pressure:—E. C. (*Redruth*); Old Paintings; J. C. B. (*Gt. Ayton*); C. C.; Self-Helper; Machinery Market; S. E. (*Chelmsford*); R. C. (*Exeter*); Gimel; C. G. (*St. Albans*); A. M. (*Rochdale*); H. E. L. G. (*Liverpool*); A. B. (*Edenfield*); Iris; W. C. (*Glasgow*); New Reader; S. H. (*London, E.C.*); J. H. (*Everton*); A. S. (*Blaydon-on-Tyne*); J. J. F. (*Shaftesbury*); H. G. (*Brentford*); J. L. W. (*Sandown*); E. L. (*Woolwich*); J. S. R. (*Glasgow*); S. C. (*Ashton-under-Lyne*); A. R. B. (*Dublin*); Horol; J. B. F. (*Eastbourne*); W. T. R. (*Newfoundland*); H. M. (*Liverpool*); W. B. W. (*Wolverhampton*); E. D. (*Deptford, S.E.*); No Name (*Manchester*); T. L. D.; H. O. B. (*Manchester*); W. T. G. (*Bristol*); M. T. O. (*Stockport*); F. W. P. (*London, W.*); J. McV. (*Newcastle-on-Tyne*); Essem; A. L. (*London, W.C.*); H. O. C. (*Croydon*); Workite; Corinthian; A. V. W. (*Cheltenham*); W. N. (*Finsbury Park*); J. F. (*San Remo, Italy*); F. H. B. (*Barking*); H. F. (*Birmingham*); Embostyro; T. G. (*Liverpool*); J. C. (*Bedale*); D. C. D. (*Ossory*); J. G. N. (*Manchester*); Piano Stool; W. S. (*Rugby*); J. Moa. (*Glasgow*); A. A. (*Edinburgh*); F. S. P.; J. J. (*Kidderminster*); G. C. (*Reading*); J. H. (*London, N.*).

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